CIVIL ENGINEERING

GOW
SOIL BORINGS
BY Raymond

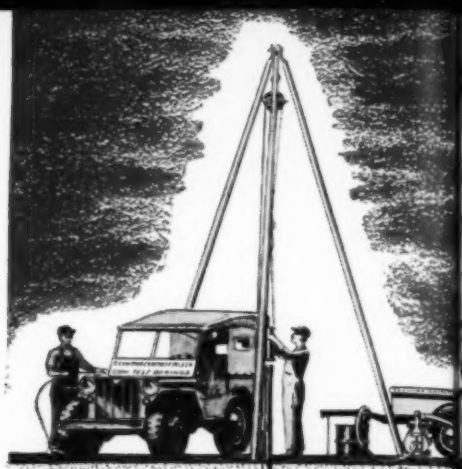
Carefully made soil investigations are of great value to Owners, Architects and Engineers in the selection of building sites and the determination of proper structural foundations.

Specify dependable Gow borings by Raymond and you will secure information that will supply the basis for sound engineering decisions.

Their low cost will surprise you.

• • •

THE SCOPE OF RAYMOND'S ACTIVITIES includes, in addition to borings for soil investigation, every recognized type of foundation construction—concrete, composite, precast, steel, pipe and wood piles. Also caissons, underpinning, construction involving shore protection, shipbuilding facilities, harbor and river improvements, and cement mortar lining of oil and water pipe lines 4" to 144" in diameter by the Centriline Corporation, a Raymond subsidiary.



GOW DIVISION

Raymond
CONCRETE PILE CO.

140 Cedar Street, New York 6, N. Y.

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You can't Slip on Klemp Serrated Steel Grating CATWALKS

Hoping to eliminate accidents caused by workers slipping on cat-cracker gratings, the Phillips Petroleum Company asked Klemp to design a new, slip-proof grating. The result was: super-safe Klemp Serrated Steel Grating. Even workmen whose shoes are slick with muck and oil walk safely on it, for its saw-shaped teeth grip their shoes, and positively prevent slipping. That's why Phillips, Standard Oil, Shell, and many other companies now use Klemp Serrated Steel Grating to avoid accidents and costly damage suits. This grating is available either in hydraulic-riveted or electro-forged styles.*

KLEMP SURE FOOTED AS A CAT SERRATED STEEL GRATING

Rugged Klemp Serrated Steel Grating is fireproof. Ice, snow, and dirt fall through it. Its open construction permits free access to water, chemicals, light and air; and hurricanes do not harm it as its rugged carbon steel gives with the wind. Get full details on how Klemp Serrated Steel Grating can boost safety and save you money. Write today for hot-off-the-press 1951 Klemp Grating Catalogue!

* Klemp's 44 years' experience as grating specialists guarantees perfect fabrication to your most exacting specifications.

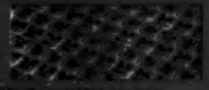
KLEMP SERRATED STEEL GRATING

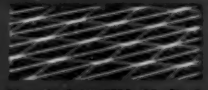
WM. H. KLEMP CO. General Offices: 6610 South Melvina Avenue, Chicago 38, Illinois

KLEMP, world's largest manufacturer of open steel meshes

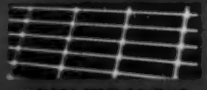
ALSO MAKES THESE OTHER PRODUCTS FOR THE OIL INDUSTRY:

HEXSTEEL AND FLOORSTEEL GAMMETTED LOCKING REINFORCEMENT MESHES FOR CAT CRACKERS





DIAMOND RIVETED GRATING

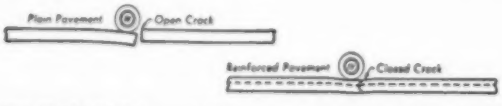


WELDED STEEL GRATING

CIVIL ENGINEERING, The Magazine of Engineered Construction, April, 1951. Vol. 21, No. 4. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 West 39th Street, New York, N. Y. Price 50¢ a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage 75¢ and foreign postage $1.50 additional. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 5, 1918.

Saving Lives—Time—Money on

LONGER PAVING SLABS, fewer expansion joints, improve riding qualities on concrete highways reinforced with American Welded Wire Fabric. Reduced rate of cracking, prevention of heaving and spalling also reduce maintenance costs, increase the service life of the highway.



AS THE WHEEL LOAD approaches an open crack in plain pavement, one slab end carries the entire load. As the wheel approaches the closed crack in pavement reinforced with American Welded Wire Fabric, both slab ends, instead of one, carry the load, preventing damage to the slab and to the subgrade.

ON NEW YORK'S WEST SIDE HIGHWAY American Welded Wire Fabric helps to improve the riding comfort, and Multisafty Cable Guard provides maximum driving safety for the motoring public. American Welded Wire Fabric fortifies the ground slab in all directions, reduces the rate of cracking, prevents progressive damage and insures additional years of trouble-free service. Multisafty Cable Guard provides maximum safety at low maintenance cost.

EASILY PUT IN PLACE, these big sheets lie flat, stay in place during pouring. The many small, closely-spaced members distribute the strength of high yield strength steel evenly throughout the slab. This fabric reinforcement makes possible longer slabs, fewer joints, hence smoother riding. Ease of handling and higher allowable stresses make for appreciable savings in labor and material costs. Long, economical service from roads in which it has been used is the main reason why American Welded Wire Fabric is the world's most widely-used prefabricated reinforcement for concrete highways.

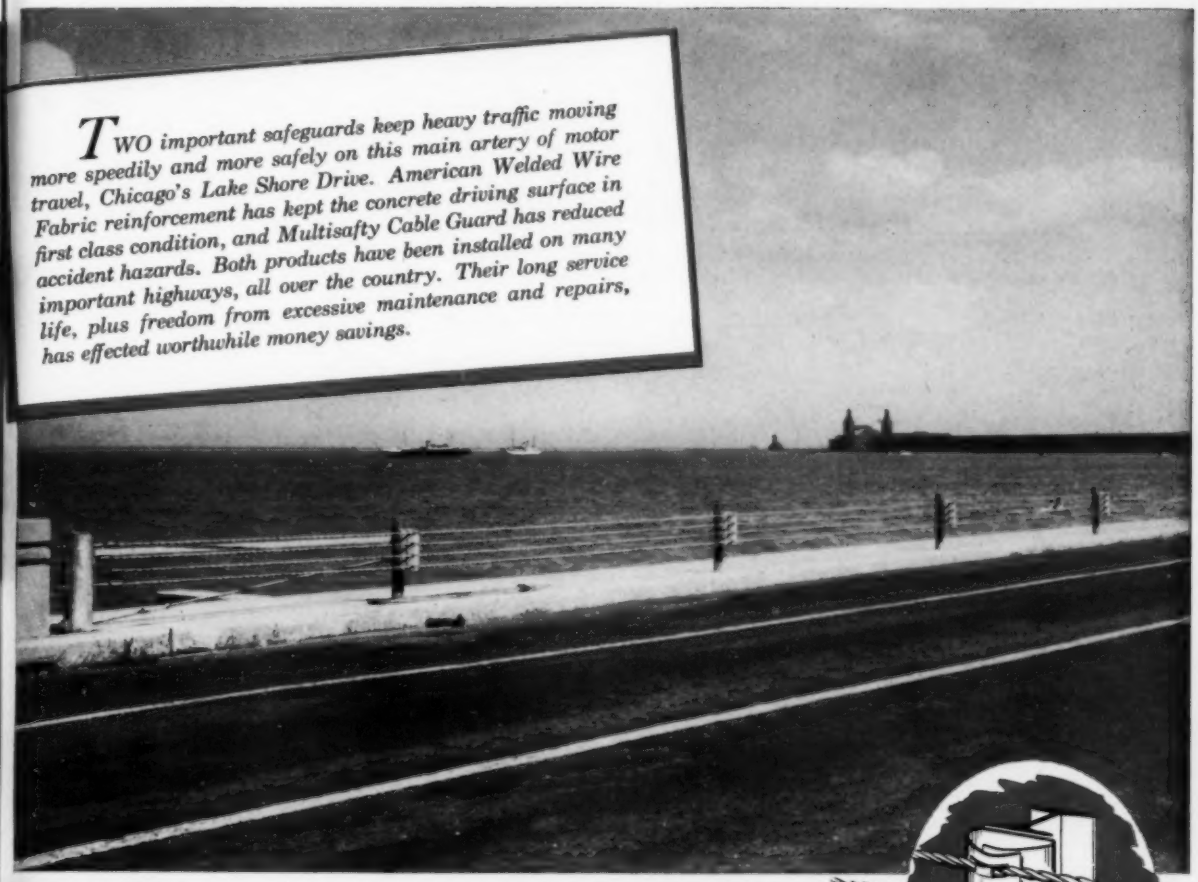
USS

AMERICAN WELDED WIRE FABRIC

UNITED STATES STEEL

the Nation's Express Highways

TWO important safeguards keep heavy traffic moving more speedily and more safely on this main artery of motor travel, Chicago's Lake Shore Drive. American Welded Wire Fabric reinforcement has kept the concrete driving surface in first class condition, and Multisafty Cable Guard has reduced accident hazards. Both products have been installed on many important highways, all over the country. Their long service life, plus freedom from excessive maintenance and repairs, has effected worthwhile money savings.



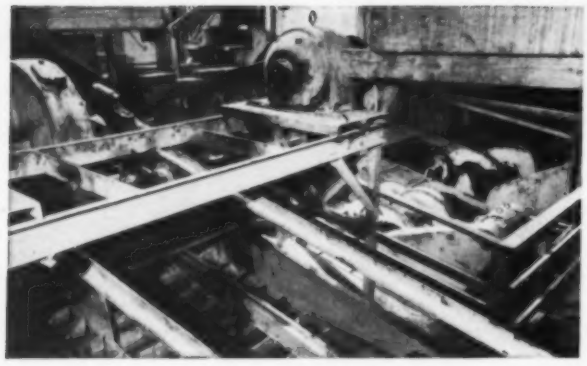
MULTISAFTY CABLE GUARD has proved so effective on the nation's network of roads and highways that it has been adopted as a standard material by many state highway commissions. The four galvanized wire cables, attached to a galvanized resilient spring bracket, absorb the impact of collision and side swiping, prevent off-the-road crashes and capsizing of cars at high speeds. In addition to its long life and excellent performance in all climates at all seasons, Multisafty Cable Guard has established records for low installation and maintenance costs.

THE FOUR GALVANIZED wire cables of Multisafty Cable Guard possess the tremendous strength needed to withstand terrific impact. The offset spring brackets on which the cables are mounted help to absorb impact stresses and to deflect vehicles which collide with the guard. Posts and anchorages are sufficiently sturdy to withstand the total stresses transmitted by cables and springs. No painting is required, therefore, upkeep costs are low.

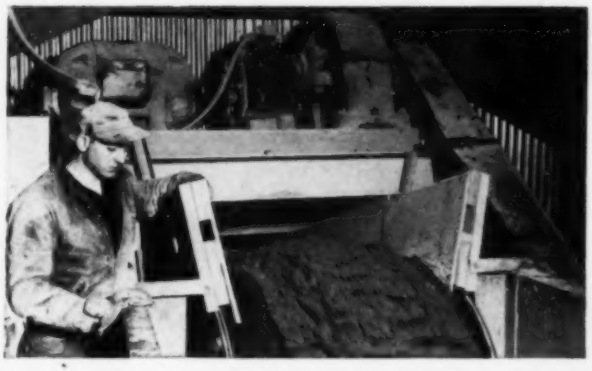
and MULTISAFTY HIGHWAY GUARD

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO — COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS

TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM SOUTHERN DISTRIBUTORS — UNITED STATES STEEL EXPORT COMPANY, NEW YORK

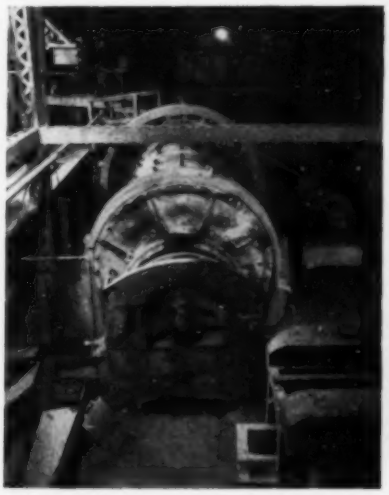


Aggregate under 6 inches is separated in shakers at screening plant. A G-E 5-hp motor drives shakers. Plant is completely automatic.



Carrying cement mix along this indoor conveyor system is a crucial step in construction of the dam. Sturdy G-E 100-hp motor drives the belt.

Aggregate for batching plant at Hungry Horse Dam is carried 1600 feet up the canyon wall by conveyor, driven by reliable G-E 100-hp motors in wooden sheds at intervals of 250 to 300 feet.



This Marcy rod mill, used in the gravel-crushing operation at the screening plant, is driven by a G-E 200-hp motor (right center). The motor is protected against heavy dust.

push-button aggregate processing at 700 tons/hr.

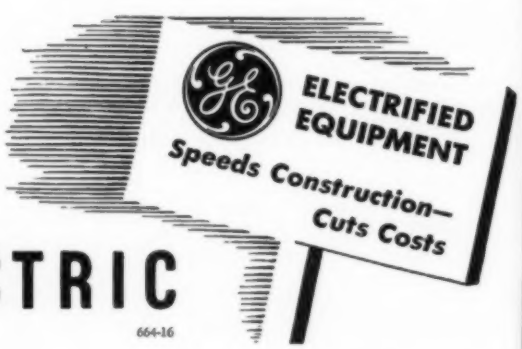
... Electrically

General-Shea-Morrison, contractors for the Bureau of Reclamation's Hungry Horse Dam, are going all-out with electric equipment. Best example is their aggregate plant with its network of interconnecting conveyors geared to process 700 tons of raw aggregate every hour. It's one of the most modern installations of its kind in the country—strictly a push-button operation from raw aggregate handling to mixing. Only with modern electric drives can this world's fourth largest dam be completed on schedule in 1952.

As time goes on, contractors are discovering more and more that it pays to electrify. With co-ordinated use of G-E motors and control and G-E power-distribution systems, they're getting safer, more flexible, and more efficient operation. *Apparatus Department, General Electric Company, Schenectady 5, N.Y.*

Ask him Today!

Whether you buy or build construction equipment, your G-E representative can show you how to do a better job —at lower cost—by complete electrification. Write him now, and he'll call on you at your convenience.



GENERAL ELECTRIC

664-16

"Washington calling!"

We were expecting this call. In a sense it is the people of America on the other end of the telephone. For some time they have been calling upon our government to take whatever steps are necessary to equip our fighting men for any job they may have to do.

Korea has proved the fallacy of limited preparedness. You know now that the nation is girding for survival. The people of America have said—and rightly—that private industry should provide the Armed Forces with whatever is necessary.

Machines are being mobilized. "Caterpillar" products are wearing olive drab once more. Because of large military demands your present machines may have to work longer than you had anticipated.

You can get many extra hours of machine service life if you:

1. **Follow a sound program of operation and maintenance.**
2. **Consult your Operator's Instruction Book, using it as a constant guide in caring for your machines.**
3. **Secure the assistance of your "Caterpillar" dealer who now, more than ever before, is your working partner for the grim job that may lie ahead.**

• • •

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CATERPILLAR

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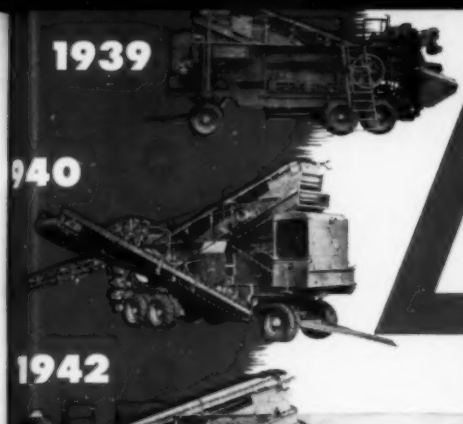
Diesel Engines • Tractors • Motor Graders • Earthmoving Equipment



4 Austin-Western CRUSHING PLANTS

for Arthur & Allen of Pueblo, Colorado

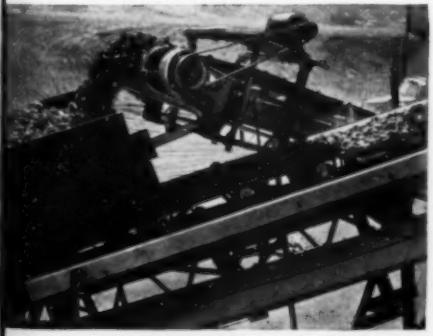
Crushing slag from the Colorado Fuel & Iron Company's Pueblo plant to produce ballast for the Santa Fe, Missouri Pacific and Rock Island Railroads.

The man at the feed conveyor in the foreground is salvaging iron from the slag.

This, the fourth Austin-Western Crushing and Screening Plant purchased by Arthur & Allen over a ten-year period, has an average run of 350 tons per hour and has reached a peak output of 420 tons per hour. The finished product is, in almost all cases, 1½" minus to ⅜" plus. The percentage of crush is approximately 60.

Whatever your production requirements, an Austin-Western Plant, designed and tailor-made to meet them, will do the same sort of outstanding job for you. Let's talk it over.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U.S.A.



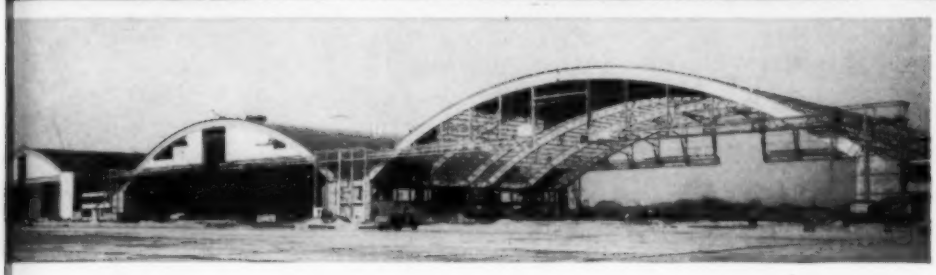
These conveyors are carrying the combined output of jaw and roll crushers.

The loading hopper is arranged to accommodate two trucks at one time.

BUILDERS OF ROAD MACHINERY SINCE 1880

Austin-Western

HUGE STEEL-ARCH HANGARS go up fast!



▲ Principal roof members are curved, riveted plate girders. Pinned at supports and crown, they have a constant depth, back to back of flange angles of 5 ft. 7 in. and rise 49 ft. 11 in. to provide a clear height at center of 75 ft.

◀ Interconnected by 2-story steel frame lean-tos ranging in width from 39 to 103 ft., the hangars form a building 1,148 ft. long and 219 ft. wide. Each hangar provides a 300 ft. clear floor space.

302′ Steel-Arch Spans SIMPLIFY ERECTION . . .

PROVE MOST ECONOMICAL TYPE OF CONSTRUCTION

PROJECT: Three hangars and interconnecting lean-tos at New York International Airport, Queens, New York City.

DESIGNED BY: Port of New York Authority, Roberts and Schaefer Company, Consulting Engineers. Lorimer and Rose, Associate Architects.

GENERAL CONTRACTOR: Stock Construction Corporation.

STRUCTURAL STEEL: 3,600 Tons. Fabricated and erected by American Bridge Company.

Erected in 13 months (complete with heating, fire-alarm and lighting systems) the three giant, 300′-wide, 219′-long hangars with interconnecting 2-story lean-tos have set a record for this type of construction—both as to length of spans and speed of construction.

Erected in four sections, the 302′-steel arches are pinned at the supports and crown to provide a clear height at the center of 75 ft. Each hangar is large enough to accommodate 6 Douglas DC-6 transports or four double-deck Boeing Stratocruisers. In addition, parking aprons on both sides of the building can take 15 aircraft of the type having a turning circle of 175 ft., or 19 of the smaller type having a turning circle of 150 ft.

The decision to use long panels between solid web steel arches for this important project was made after studied consideration of other types of construction materials. And again steel proved most economical by meeting all comers in competitive bids.

If you'd like to know more about the advantages of American Bridge Company *fabricated* and *erected* steel construction, just call our nearest office.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI CLEVELAND · DENVER · DETROIT · DULUTH · ELMIRA · GARY · MINNEAPOLIS · NEW YORK PHILADELPHIA · PITTSBURGH · PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON UNITED STATES STEEL EXPORT COMPANY, NEW YORK

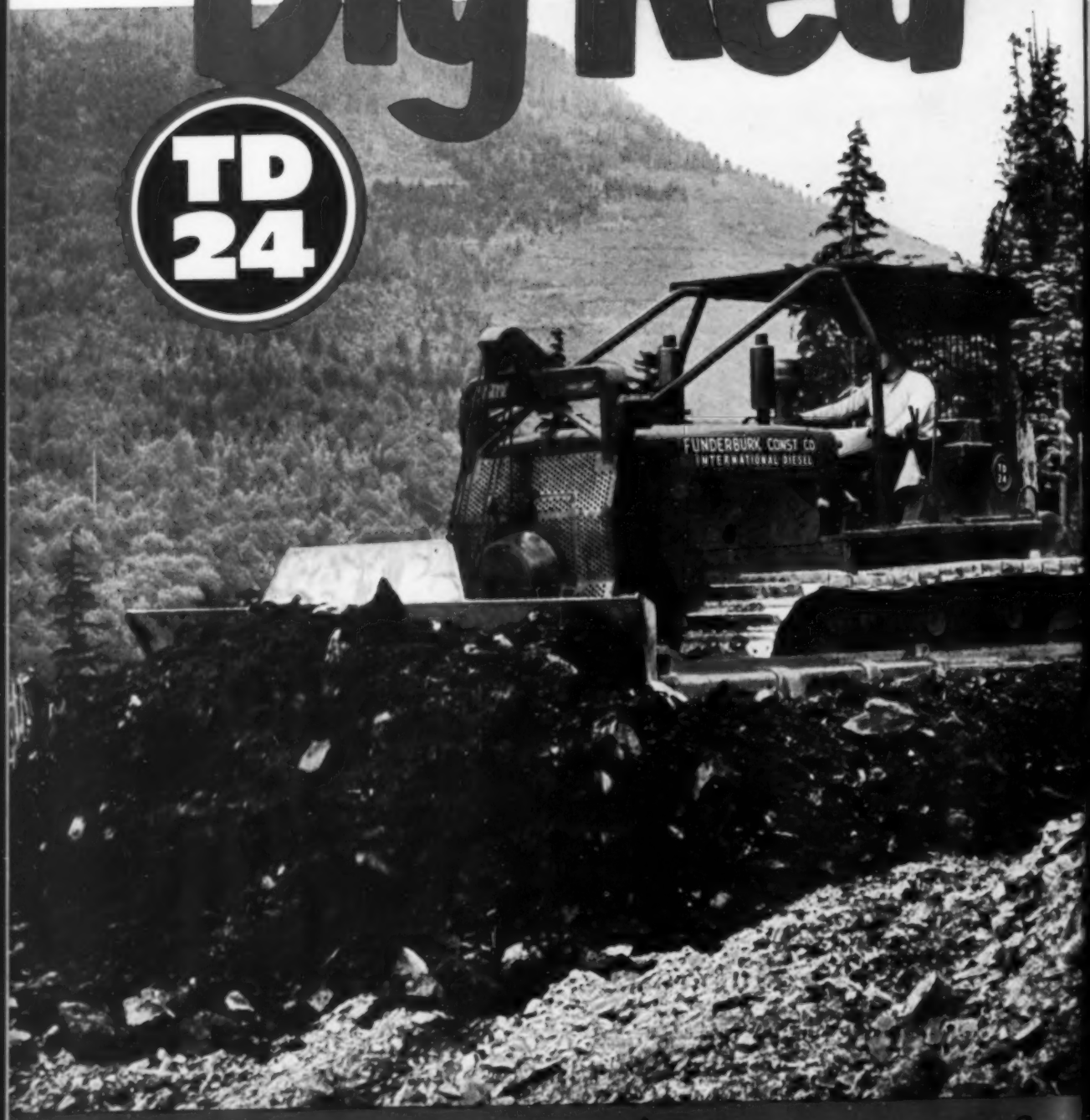
USS

AMERICAN BRIDGE

UNITED STATES STEEL

"Big Red"

TD 24



Beats Blue Mountain

Read how the International TD-24 pays off, helping build mountain-top radio station.

Out near Seattle rise two 3,000-foot peaks that have suddenly become mighty important. Blue Mountain and Wheeler Mountain, a mile apart, are the bases for new antenna towers of what will be one of the most powerful radio stations ever built.

Toughest part of the construction job was building roads up the mountains. First the Funderburk Construction Company conquered Mt. Wheeler. Then they bought a new International TD-24 and started gouging out the rocky road to the top of Blue Mountain. And with the big red champ on the job, they moved faster, easier, more profitably.

"It's the TD-24's power and Planet Power steering that pay off," says Ed Funderburk. "The TD-24 stays up in the bank easier and pushes bigger bladefuls farther than any other tractor can. This means lots more material moved at the end of the day."

It means more work done on any job. See for yourself. See your International Industrial Distributor and get the real low-down on the TD-24. And check up on the service your distributor can give you over the hard-working years ahead. With factory-trained mechanics and ample shop facilities, backed up by International's strategic network of parts depots across the country, your International Industrial Distributor is all set to keep your International power on the job for you and the nation!

INTERNATIONAL HARVESTER COMPANY
CHICAGO 1, ILLINOIS

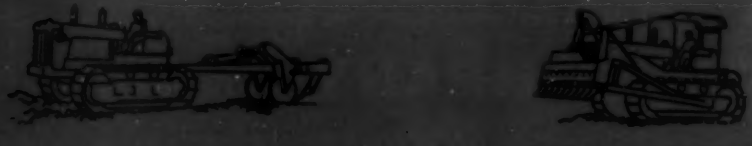
TOP THIS ONE! Building a 14-mile road to "top" Blue Mountain means dozing down 250,000 cubic yards of material—mostly rock. It's a job that calls for the brute power of the world's most powerful crawler—the International TD-24.

RECESS FOR THE CHAMP! It's child's play for Ed Funderburk's TD-24 when the skinner lays off dozing long enough to pull stumps from the new road's right-of-way.

INTERNATIONAL HARVESTER

INTERNATIONAL

POWER THAT PAYS



Modern *Magic Carpet*

● This beautiful asphalt highway is truly the "modern magic carpet" for motorists and road-builders alike.

For pleasant travel there is nothing to equal the smooth, cushioned feel of an asphalt road. The unbroken, black surfaces are easy on the eyes; the absence of road glare makes driving easier and safer.

Asphalt helps highway departments and contractors reach new speeds in road-building. It is easy to lay; it sets rapidly. Aggregate already on the road or close at hand keeps material costs at rock-bottom low.

Care of an asphalt road takes a minimum of time, labor, and materials. Its beauty has a practical side—this road is long-wearing and water-proof.

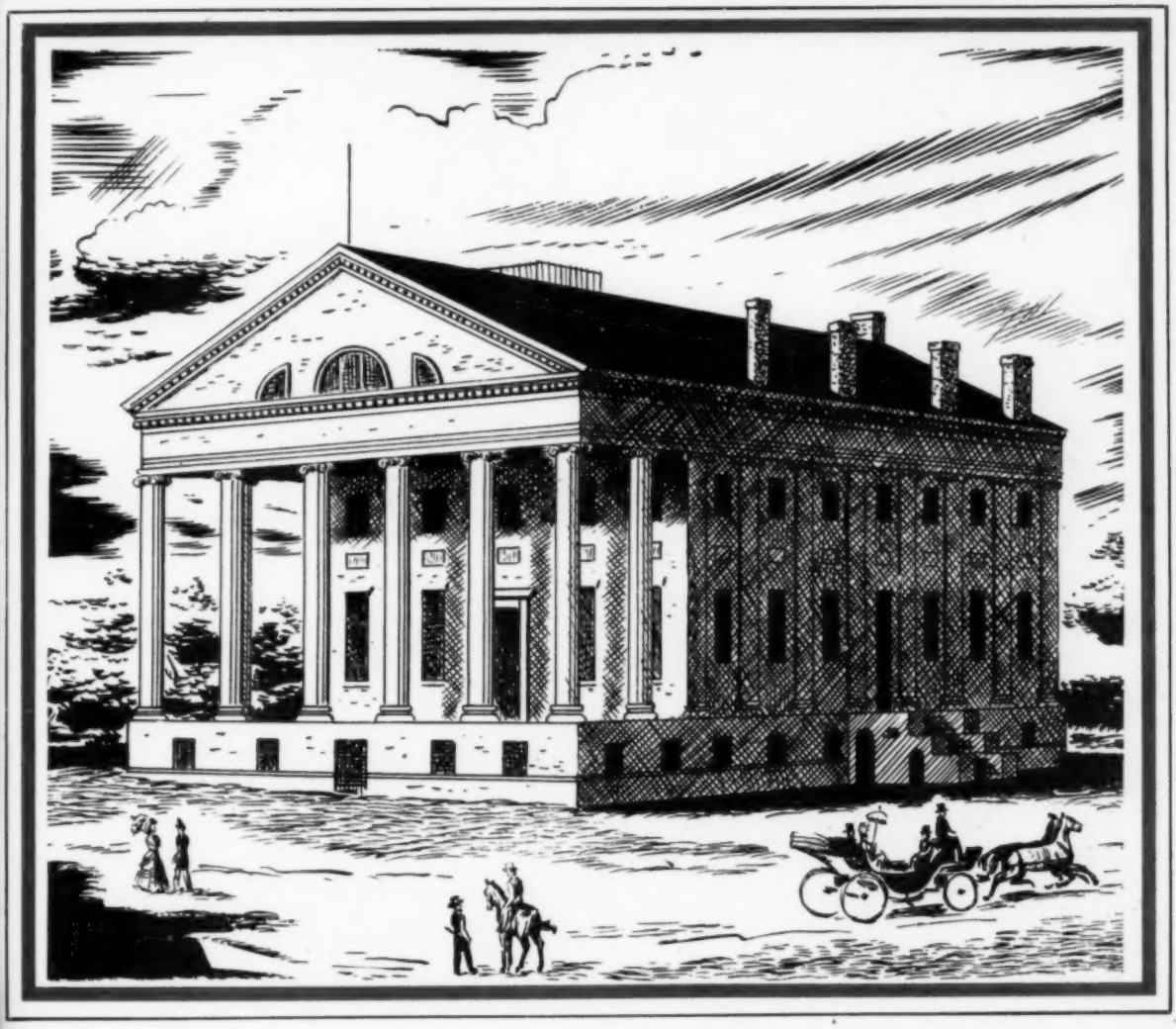
Standard Oil helps road-builders even further through its five conveniently located refineries in the Midwest. Prompt and dependable deliveries are assured. A Standard Oil Asphalt Representative will be glad to suggest economical types of asphalt construction to meet your needs.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

STANDARD OIL
ASPHALT

STANDARD OIL COMPANY (INDIANA)

STANDARD



Richmond's State Capitol, completed in 1792, as it looked 100 years ago

Richmond, Virginia, has a cast iron water main in service that was installed well over a century ago. In those stage-coach days, *traffic shock* caused by heavy trucks and buses was, of course, undreamed of. There were no sewers and other underground conduits to cause soil disturbances and settlement. Yet this rugged old pipe had what it takes in shock-strength and beam-strength to meet unforeseen stresses. Strength, as well as effective resistance to corrosion, are prerequisites of long life in pipe to be laid under city streets. This is evidenced by the fact that cast iron water and gas mains, laid over a century ago, are still serving in the streets of more than 30 cities in the United States and Canada.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

NUMBER FOUR OF A SERIES

NEW A.C.I. BUILDING CODE...

Recognizes the Advantages of the A305 Reinforcing Bar

The revised "Building Code Requirements for Reinforced Concrete" has now been formally ratified by the American Concrete Institute.

This new code contains some of the most important changes made in many years. These changes were made possible by the new A305 reinforcing bar. By using A305 bars under the new code, you get better, more economical structures.

WHAT ABOUT YOUR LOCAL CODE?

To participate in the benefits offered by the new A.C.I. Building Code, your local code must be changed to conform. Take action, now, to see that your local code is changed!

Copies of the new A.C.I. Code may be obtained, for a small charge, from the **American Concrete Institute, 18263 W. McNichols Rd., Detroit 19, Mich.**

- **INCREASES ALLOWABLE BOND STRESSES**
- **ELIMINATES HOOK ANCHORAGE**

CONCRETE REINFORCING STEEL INSTITUTE • 38 S. Dearborn St., Chicago 3

VOLUME 21

NUMBER 4

CIVIL ENGINEERING

APRIL 1951

THE MAGAZINE OF ENGINEERED CONSTRUCTION

IN THIS ISSUE

SOCIETY NEWS

NEWS BRIEFS

DEPARTMENTS

U·S·S I-BEAM-LOK Open Flooring and U·S·S STEEL H-BEAM Bearing Piles

...economical, long-life construction for trestle-type bridges

Military Trail Bridge across the Palm Beach Canal shows how U·S·S I-Beam-Lok Open Flooring made a safe, sturdy bridge floor at low cost. Cleary Brothers Construction Company of West Palm Beach, Florida, was the contractor.

● Strong, safe, low-cost bridges utilizing U·S·S I-Beam-Lok *Cleated-Tread* Open Flooring and Steel H-Beam Bearing Piles have proved highly satisfactory in Palm Beach County, Fla.

These all-steel bridges carry a 22′ roadway consisting of 5″ Open I-Beam-Lok. The deck is supported on rolled beam stringers, which rest, in turn, on standard H-Pile bents on 30′ centers. Abutments also consist of H-Pile bents with a 36″ plate welded across the abutment at the top of the piles to act as a retainer for the earth fill.

According to County Engineer J. M. Boyd, these structures have proved to be simple and economical to erect. The only equipment needed is a small crane for handling the pile and the I-Beam-Lok, a medium-sized pile driver and a small welding machine.

Best of all, the cost of such bridges is exceptionally low. Labor is minimized since a small amount of field welding is all that is necessary to install the steel supporting beams and I-Beam-Lok Flooring.

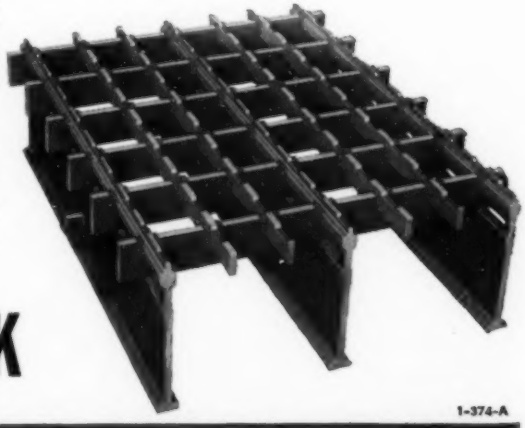
UNITED STATES STEEL COMPANY, PITTSBURGH
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

CLEATED-TREAD NON-DIRECTIONAL SURFACE means safer, surer traction

U·S·S I-Beam-Lok Open Flooring gives you a uniform, firm-gripping, non-directional riding surface. The modified I-Beams have raised, narrowed ribs level with tops of the supplementary bars. Both bars and beams are made with irregularly spaced notches about ¼″ deep and ¾″ long.

This *Cleated-Tread* floor is made in two types—type PL in which the main carrying beams are placed parallel to traffic and type TR running transverse to traffic. They are essentially the same in depth, strength properties and size of openings. They differ only in the pattern of the riding surface and in weight—type TR weighing approximately 18.8 lbs./sq. ft. and type PL, approximately 19.1 lbs./sq. ft.

To find out more about U·S·S I-Beam-Lok Open Flooring with high traction Cleated-Tread Surface, contact the office nearest you. Our engineers will be glad to discuss its many advantages with you.

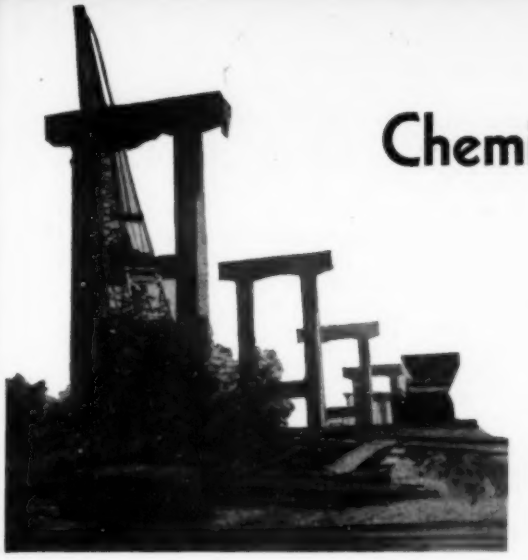


USS TRADE MARK

I-BEAM-LOK

1-374-A

UNITED STATES STEEL



Chemicals stop cofferdam leaks

C. MARTIN RIEDEL, M. ASCE

Partner, Chemical Soil Solidification Co., Chicago, Ill.

COMPLETED PIER BENTS are ready to support bridge carrying U.S. Highway 62 across Cumberland River, Kentucky.

NEAR Kuttawa, Ky., the Kentucky State Highway Department is completing a bridge to carry Route 62 across the Cumberland River. Traylor Bros. Co. of Evansville, Ind., has the general contract for the substructure and approaches. The bridge, when completed, will consist of heavy deck plate girders resting on two-post concrete bents founded on rock and constructed in cofferdams.

All the pier foundations except that for Pier 9, near the north bank of the river, were built without unusual incident. In the case of the cofferdam for Pier 9, however, unexpected difficulties were experienced, which form the subject of this article. These difficulties included deeply fissured faults in the rock, large sand boils, and underground water chambers which vented artesian water into the cofferdam when punctured by steel sheetpiles and wide-flange columns.

Two test borings put down 28 ft apart within the area of the cofferdam indicated that the natural rock line would be similar to that found in the cofferdams for the other piers—about 50 ft below ground level. All cofferdams were 22 × 52 ft in plan, constructed of interlocking steel sheetpiles driven to refusal and braced with 12-in. I-beam wales, cross braces, and corner braces.

As soon as the excavation inside the cofferdam for Pier 9 reached rock, narrow, steep, vertical crevices were found within about 6 ft of each of the misleading test borings. These two faulted areas occurred just at the location of the two subbases for the concrete pier bents, where the heaviest load concentrations from the superstructure would be. Therefore the engineers decided to drive two steel sheetpile inner cofferdams, approximately 11 × 15 ft in plan around the two subbases, and to drive to refusal, into the two fault areas, as many 12-in. wide-flange column sections as possible. Penetrations of 24 ft and more below the bottom of the cofferdam were reached. Because of the obstructing heavy corner braces of the outer cofferdam, the sheeting for the inner cofferdams could not be driven continuously and therefore could not hold water.

As soon as the steel columns, driven in the faults inside the inner cofferdams, penetrated a stratum of loose, soft rock, heavy boils of water began to flood the pit. This inflow, together with the heavy leakage from unevenly seated, over-driven, and split sheetpiles in the outer cofferdam, could hardly be handled by two 6-in. centrifugal pumps working continuously.

Chemical Solidification Adopted

After fruitless attempts to stop the leakage by conventional methods, the contractor proposed chemical solidification of the substrata along the bottom of the sheetpiles of the outside cofferdam. This step was approved by the engineers.

The chemical process here used is based on the invention of a Dutch mining engineer, Dr. H. J. Joosten. Sodium silicate, generally known as water glass, reacts with calcium chloride solution to form a silicic gel which, if properly injected, will cement loose sand, gravel and cinders as well as broken stone, concrete and natural rock. When injected through pipes into natural layers of sandy soil, either dry or below the groundwater level, these solutions form a soft sandstone which is impervious to water even under considerable hydrostatic head and has bearing strengths up to 50 tons per sq ft, depending on the silica content of the natural sand strata. Average bearing strengths of 20 to 25 tons per sq ft can be expected. The process is not generally applicable to strata containing more than 25 percent of clay or silt, nor to sand passing sieves much finer than 125-mesh. A laboratory examination of the materials at the site of Pier 9 indicated that these materials were suitable for chemical solidification.

Leaking sheetpile interlocks were sealed by injecting the two chemicals through holes burned in the inside pan of the sheets. Short 2-in. nipples were welded in the holes, and to them special injector-Y's were attached to carry the chemicals.

To seal the bottom of the piles of the outside cofferdam, $1^1/_4$-in.-dia pipes 45 to 50 ft long, with flush couplings, were jetted down along the outside of the sheets under slight water pressure to keep the perforations open in the injection points at the ends of the pipes. As soon as refusal was reached, the two chemicals were pumped in alternately while the pipe was withdrawn slowly. Injection depth, measured from the bottom, averaged from 4 to 12 ft, according to the leakage conditions, and in extreme cases from 20 to 39 ft.

The deep fissures in the inner cofferdams, which were sealed last, presented the toughest sealing problem. The sand boils, under a head of 48 ft or more, acted like quicksilver. As soon as an injection pipe stopped the boil, the water quickly built up enough pressure to force itself through nearby weak spots, whence it gushed out in undiminished force and quantity. By the exercise of patience and stubbornness, the water was chased to

a solid rock corner. In this manner each crevice was plugged. Concrete was then poured in between the wide-flange steel columns driven into the crevices to strengthen the fault; the columns were burned off 6 ft below final footing grade; and the concrete footings for the legs of the bridge piers were poured.

A 74-ft injection pipe at the southwest corner of the cofferdam established a record for length on such work. Through it 918 gal of sodium silicate and 857 gal of calcium chloride solution were pumped. This mammoth charge injected at record depth is believed to have controlled the rush of the powerful boil in the south inner cofferdam.

Experienced men at pumps and valve controls are needed to keep the injection pipes from becoming clogged with hardened chemical gel. On this job the crew consisted of two key men and four semi-skilled workers operating under the supervision of one engineer. Not including the time required for setting up plant, and delays due to unseasonably high river stages which twice completely flooded the cofferdam, approximately 30 working days of 10 hours each were required to seal the cofferdam for Pier 9. The work, carried out on a cost-plus basis, included 1,389 ft of driven-in injection pipe. Altogether, 11,412 gal of sodium silicate and 8,800 gal of calcium chloride were injected over a total distance of 300 ft—the distance over which the pipe was withdrawn while injecting. The direct cost, including transportation of equipment to and from the work, was approximately $14,700.

Plans and specifications for the solidification work were prepared by the Chemical Soil Solidification Co. under the supervision of the writer, who also supervised the laboratory and field work. William Traylor is in charge of the substructure work for the contractor, the Traylor Bros. Co., Inc., Evansville, Ind.; J. J. Crider is resident engineer for the Kentucky State Highway Department; and R. E. Anthony is highway bridge engineer for the U. S. Bureau of Public Roads. Sverdrup and Parcel, of St. Louis, Mo., are the consulting engineers on the design of the bridge.

CHEMICALS for solidifying soil around pier cofferdam No. 9 are stacked along bank of Cumberland River (in background). In all, 211 drums of silicate of soda solution (chemical No. 1) were pumped into ground with approximately same amount of calcium chloride flake (chemical No. 2).

INJECTION PIPE is raised slowly as chemicals are injected into soil. Two chemicals are fed in alternately during period when pipe is being pulled. While pipe is being driven, water is forced in to keep pipe from becoming clogged.

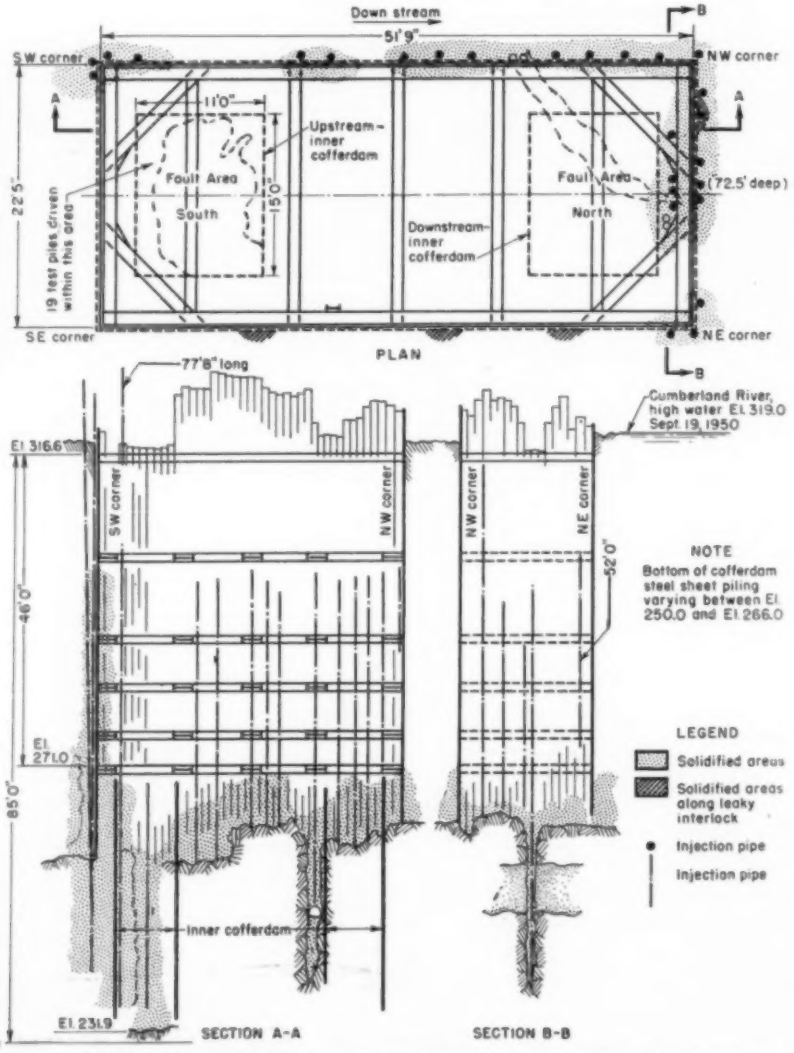


FIG. 1. PLAN AND SECTIONS of cofferdam No. 9 show location of injection pipes. Average pipe length is 45 to 50 ft. Shaded area indicates soil which was solidified. Solidified zone has average compressive strength of more than 25 tons per sq ft.

Engineers and professional unity

WILLIAM N. CAREY, M. ASCE

Executive Secretary, American Society of Civil Engineers, New York, N.Y.

(This article, based on an address delivered at recent meetings of ASCE Local Sections, is printed for the information of members at request of the Board of Direction at its meeting in Houston, Tex., February 19–20, 1951.)

THE AMERICAN Society of Civil Engineers has been the national organization of the civil engineers of this country for 99 years. The celebration of our centennial is planned for Chicago next year. Members of the Society are generally familiar with its operations and structure, its elected Board of Direction, its Local Sections, its Technical Divisions, its many committees and its Publications. However, the activities of ASCE carried out jointly with the other principal national societies of engineers seem to be almost unknown to the membership at large. Many are unaware of the very real unity that now exists in the engineering profession.

Engineering Profession Is Unified

For as far back as any of us can remember, we have heard that there should be greater unity in the engineering profession. Many of us have witnessed two unsuccessful attempts at unification—the American Association of Engineers, which is still alive, and the American Engineering Council, which is dead. The present *alleged* lack of unity in the profession is deplored in some quarters. Some engineers believe that a national organization composed solely of registered engineers is the proper agency through which all engineers should speak and act nationally on professional subjects.

I use the words "alleged lack of unity" because the fact is that the old lack of unity is no more. A federation of national engineering societies which affords an effective instrument for the unity of the profession is now in existence. No longer do we need to seek such an agency, only to seek ways to make it even better than it is. This going concern, this present unification of the profession, was accomplished nine years ago through a federation of national engineering societies. It is known as Engineers Joint Council and it represents over 120,000 engineer members of the five national engineering societies which cover the five basic branches of the profession—civil, mining, mechanical, electrical, and chemical engineering.

Engineers Joint Council Gets Things Done

The sole objective of EJC is to cope with the professional problems common to all engineers. The Council proper is composed of fifteen men: the two most recent past presidents and the secretary of each of the five constituent societies. The current president of each society also is a member, ex officio. Through these elected and appointed officers, any member of one of the constituent societies, any local section of these societies, or any individual engineer can bring to the Council any question of concern to his profession. Every member of every constituent society of EJC is represented by delegates which he and his fellow members have elected or appointed to the highest offices in their respective societies. The work of EJC is done by the Council and by committees carefully selected from the foremost engineers of the nation. All give generously of their time and talents on behalf of the profession. These committees and panels get things done. Some of the recent major tasks completed by EJC are worthy of review.

National Science Foundation Board. Last November the President of the United States appointed the members of the National Science Foundation Board as authorized under a newly enacted law. The three professional engineers appointed to this twelve-man board were candidates selected and supported by EJC. When the National Science Foundation bill was first introduced some time ago, engineering was not even mentioned in it. It was only because of the effective representations made by a panel appointed by EJC, with the American Society for Engineering Education a party to the panel, that engineering research was specifically included as one of the objectives of the legislation as enacted.

Taft-Hartley Act. Many engineers know of the success of the EJC Labor Legislation Panel in obtaining provisions in the Taft-Hartley Act which protect engineers from being forced against their will to join labor unions. At the same time the rights of engineer employees to bargain collectively are protected. On EJC invitation, representatives of the National Society of Professional Engineers and ASEE joined the labor legislation panel. Both are entitled to their share of satisfaction in this major accomplishment by the group.

U.S. Civil Service. For years, engineers have believed in the wisdom of a Committee of Engineers advisory to the U. S. Civil Service Commission. As a result of long negotiations by EJC, such a committee was appointed last year by the Civil Service Commission. In its advisory capacity, this committee will render valuable service to the profession toward correcting certain inequities which have developed as to U. S. Civil Service engineer employees, their classifications and salaries.

Army Reorganization Legislation. Army reorganization legislation introduced last year resulted in quick and effective action by EJC. As introduced in late July, this legislation held provisions which would have left the Corps of Engineers and other professional Corps such as Ordnance, Chemical and Signal without statutory guarantee of professional status. Engineering was given no recognition as a profession.

Appointment and transfer of all officers except those in three "Special Branches," were left subject to the discretion of the President or of civilians appointed by him. The "Special Branches" whose professional status was protected in the legislation were medicine, law and theology. Officers in all other branches of the Army were considered in the Bill to be one hundred percent interchangeable. Such an arrangement, if enacted into law, would have been ruinous to the morale and effectiveness of all Army engineering and scientific personnel, regulars and reserves, except per-

haps for scientific personnel in the "Special Branches."

EJC is geared for fast action when required, and fast action was taken on this Army reorganization legislation. A statement made by Gen. J. Lawton Collins, Army Chief of Staff, as taken from the published hearings last fall on the legislation follows:

> "I have an amendment that the Department of the Army would like to submit for the consideration of the Committee, in fact, two amendments, one to Sec. 306 and one to Sec. 404 of the bill. They have to do with certain requirements for the technical and administrative services. Mr. Carlton S. Proctor of Engineers Joint Council on behalf of that organization suggested amendments along these lines to Secretary Gray. After conferences and in exchange of several letters, agreement was reached by Secretary Gray and Mr. Proctor as to the wording of the amendments. . . . We are happy to submit them for the consideration of the Committee."

The EJC-sponsored amendments recommended for the Army by General Collins to a bill which the Army itself had originally introduced are worthy of quotation in full. These amendments are now in the law. They are:

> Sec. 306 (f). "Under regulations prescribed by the Secretary of the Army, officers of the Army assigned to technical, scientific, or other professional duties shall possess qualifications suitable for the performance of those duties; and, when the duties involve the performance of professional work, the same as or similar to that usually performed in civil life by members of a learned profession, such as engineering, law, medicine, or theology, they shall, unless the exigencies of the situation prevent, possess, by education, training, or experience, qualifications equal or similar to those usually required of members of that profession."
>
> Sec. 404 (e) "Nothing in this Act shall be construed as reducing or eliminating the professional qualifications required by existing laws or regulations of officers of the several different branches of the Army."

It is believed that this is the first time engineering has been classified specifically in national legislation as one of the learned professions.

National Water Policy Statement. Another noteworthy accomplishment of EJC in 1950 was a published statement by a panel of specially qualified engineers entitled, "Statement of Desirable Policy With Respect to the Conservation, Development and Use of the National Water Resources." Culminating two years of study by the Water Policy Panel, the Statement was the result of the voluntary contribution of time and ability of 80 outstanding members of the profession. Generally acclaimed as a statesman-like document, it sets forth in frank terms a critical appraisal of current practices in respect to development of the country's water resources and recommends principles on which a sound over-all policy should be based. More will be heard from the EJC Water Policy Panel after it reviews the three-volume report of the President's Water Policy Commission released in December 1950 and February 1951.

Engineering Manpower Commission. ASEE now is cooperating actively with EJC in one of the most important jobs ever undertaken by the profession, a program for the proper utilization of engineering manpower in national defense. Last September the Chief of the Manpower Office of the National Security Resources Board, by letter, asked EJC to prepare a program "for the most effective utilization of engineers in the national effort and to make recommendations as to how such a program could be best administered." This request led to the appointment of an EJC Engineering Manpower Commission. The National Security Resources Board made its request to EJC because it recognized EJC as the organization which represents the engineering profession nationally.

All discussion by the Commission and its working committee emphasized one fundamental and essential condition of any program of defense. This condition is that any defense program for the survival of the United States as a free democracy in the world-wide struggle for control will depend on the use of superior and prior scientific and engineering skills to offset the superiority of numbers which the free nations lack.

On December 20, 1950, the EJC Manpower Commission made its first report to NSRB. The report contained recommendations and the reasons to back them up. It pointed out that, in the opinion of the Commission, there will be by 1954 a cumulative shortage of 40,000 engineering graduates. This opinion was based on the assumption that present conditions will continue. Any expansion of effort will of course make the shortage more critical.

The essentials of the EJC Commission's recommendations are:

1. Registration of all engineers and engineering students;
2. The establishment by legislation, of a National Scientific Personnel Board to develop criteria, and to review registrations; and
3. The constitution of a Reserve of registrants meeting established criteria, with allocations of engineers both to industry and the military supervised by the National Scientific Personnel Board.

In acknowledging, on January 13, the December 20 recommendations of the EJC Engineering Manpower Commission, the NSRB Manpower office said in part,

> "the concept of the National Scientific Personnel Board, which was recommended by the Engineers Joint Council and other scientific organizations, has been endorsed."

The foregoing are recent examples of EJC accomplishments at the national level for the profession and the public. Many more could be cited, but these should suffice to show that EJC has been representing the profession effectively and can continue to do so. These and similar accomplishments are matters of record. They are not promises, claims or generalities. Last year and for the past several years, the profession has been active and unified in EJC to a degree never before attained.

Your Society, ASCE, has taken an active part in every EJC activity. Members of ASCE have been the leaders in many of its most valuable achievements. On occasion engineering groups outside of the five EJC Societies, such as ASEE and NSPE, have been asked to participate on a project. Such outside help usually has been of material assistance to the success of a particular job.

Engineers Council for Professional Development

In addition to ASCE participation in the work of EJC, our Society is a major unit in another federation of engineering societies, the Engineers Council for Professional Development. Delegates from the five EJC societies, plus delegates from the American Society for Engineering Education, the National Council of State Boards of Engineering Examiners, and the Engineering Institute of Canada, form the Council of ECPD. Organized 18 years ago, ECPD directs several committees composed of outstanding men in the profession who are selected for their particular qualifications.

For example, its Committee on Education (formerly the Committee on Engineering Schools) presents a shining record of solid accomplishment. Before the creation of the committee only 18 years ago there was no accepted standard for measuring the quality of the engineering

curricula in the colleges and universities of our country. This committee established standards. Through the work of the constituent societies of ECPD, these standards were accepted by engineering schools, by industry and by that segment of the American public interested in the subject. Then ECPD, through this its Education Committee, organized regional teams of engineering examiners. New teams have been added as required. The personnel of these teams, always most carefully selected, is changed from time to time and kept up to date in viewpoint. In the year 1949–1950, seventy schools were inspected by regional committees. The 1950 report of ECPD now lists 142 engineering curricula in engineering schools and colleges in the United States as "accredited" in one or more of the five basic branches of engineering. Many others have not as yet measured up to the standards set. When the expression, "graduation from an approved engineering school" is used in connection with such subjects as engineering registration or the description of an engineering position, it means graduation from a school in an engineering curriculum accredited by ECPD.

This achievement of ECPD in the educational field on behalf of the entire profession, but unknown to most of its members, is another fine example of the existing unity of action. ECPD is not a thing apart from the EJC societies and their close collaborators. Like EJC, it is part of all of them, jointly. The record proves that regardless of initials, these federations form a present, strong and unified national organization of the engineering profession.

Extent of Representation

The January 1951 estimate by the U. S. Bureau of Labor Statistics is that there are close to 400,000 engineers in the United States. According to the 1950 report of the National Council of State Boards of Engineering Examiners, there is now a total of 160,000 engineer registrants, counting all engineers registered in each of the 48 states. Some 20,000 of these registrants belong to the 37 state societies of registered engineers which comprise the national grouping of state societies of registered engineers organized as NSPE. The representation factor for NSPE, therefore, is about 13 percent of all registered engineers and 5 percent of all engineers.

Statistics covering the amount of overlapping in membership between the NSPE constituent societies and the EJC constituent societies are interesting to consider. During 1950 the Office of Naval Research, U. S. Navy, engaged the help of EJC to conduct, at Navy expense and under Navy supervision, a "Survey of Selected Engineering Personnel." The survey, conducted by questionnaire, covered the whole NSPE group of registered engineers, members of all the EJC Societies, as well as the members of many specialist engineer groups. Members in the junior grades corresponding to the engineers-in-training classification were not covered.

The ONR Survey report was published in September 1950. The percentages on overlapping membership which follow are derived from a table in this report which records the overlap in membership covering all the engineers who responded to the questionnaire. The tabulated figures show that 7.4 percent of the members of AIEE are also members of NSPE. For ASME the figure is 6.5 percent, for ASCE 9.4 percent and for AIChE 2.9 percent. The AIME figures were not tabulated but most will concede that even a lower percentage of mining engineers than of chemical engineers are registered and belong to state societies of registered engineers. With the miners out of consideration, the table shows that of the members of the EJC Societies reporting, 7.6 percent belong also to NSPE, and that 15 percent of the total membership of NSPE are members of one or more of the five EJC societies.

The record of recent EJC accomplishments and national recognition shows that EJC can and does effectively represent the profession on subjects of national scope and importance. No basic change in its present organization pattern appears indicated as necessary or desirable. EJC's record and the statistics should provoke fruitful thought among those few of our members as well as other engineers who argue for abandoning EJC in favor of some other organization to serve the same field.

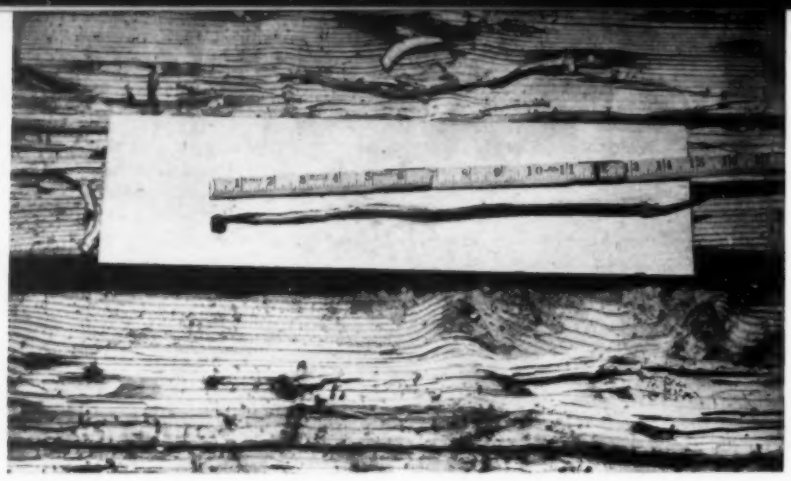
Nearly a hundred separate national societies of engineers, both small and large, exist in the United States today. This is no time for dissention among any of them. The best and quickest way to realize the ideal of a completely unified profession is to build now upon the five national societies which represent the five basic branches of the engineering profession. The present federation of these five Societies in EJC is the nearest approach to complete unity of the profession our country has ever seen.

No organization ever was so perfect that it could not be improved. EJC is no exception to the rule, and effort is constantly applied toward improvement. Any assertion, however, that the engineering profession is not unified and has no organization qualified and able to speak for it on subjects of national concern to engineers and the public is without valid grounds and is untrue.

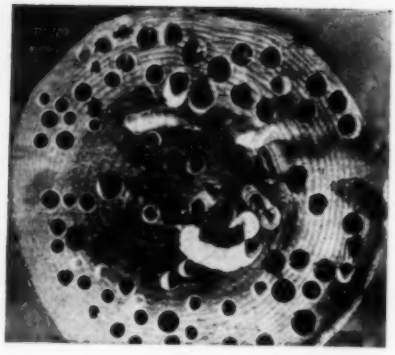
ASCE participation with its brother societies in joint endeavors serves to complete the picture of ASCE service to its members. In spite of the importance of many of them, these joint endeavors have cost our separate treasuries very little. This is because the type of project jointly undertaken by EJC in the interest of the profession usually is such as can be accomplished by specially qualified members, and these members give generously of their services to their fellows. Such giving is a primary characteristic of any learned profession.

When it comes to services which ASCE furnishes directly to its members the story is different. This is not because our members are less generous of their time on ASCE tasks and committees than on EJC assignments. It is rather that all the routine operating costs of the Society such as paper, printing, and supplies—all the things we buy or do—are subject to the same inflated prices faced by other business organizations. ASCE operates under the double handicap of stratospheric costs coupled with a fixed selling price, our dues rate. This dues rate has been fixed, not since last December like the price of automobiles, but since 1921. Obviously, ASCE is forced by financial limitations to omit or to curtail many services which it should render its members. ASCE needs, and deserves, greater financial support by its members.

Every engineer who believes that engineering is a profession should help to increase the effectiveness and the unity of his profession—by active participation in the work of the national society of his respective basic branch. Thus will ASCE and EJC be made stronger, to the benefit of all engineers. And thus will the products of engineering, in ever greater measure, in peace or war, continue to serve all the people of our beloved country.



TEREDO 15 in. long was found in wood from Marine Railway, N.O.B., Kodiak, Alaska. Teredo is the genus of mollusks containing the typical shipworm, the type of the family Teredinidae.



SECTION CUT from untreated fender pile on Adak, Alaska, shows marine borer action. Section was 1 ft above sand in 30 ft of water.

More basic research vital in fight

JOSEPH F. JELLEY, M. ASCE, Rear Admiral, CEC, USN,

MARINE BORERS have, for centuries, plagued the builders and designers of waterfront structures, yet our fund of knowledge of the physiology and habits of these creatures is still meager. There is no field I can think of that is less appreciated or less understood by engineers, although the annual damage to waterfront structures in this country alone still totals many millions of dollars. The same mistakes have been made over and over again, while research and investigation has been spasmodic and limited.

The first systematic approach to the problem in this country did not begin until 1922, when under the direction of Col. William Atwood, the National Research Council conducted some investigations on the distribution, classification and identification of the different types of borers. After this initial impetus, interest dropped greatly, and the studies were carried on by Dr. William F. Clapp almost single handed.

Effects of Creosote Studied

At present, in an attempt to throw some light on this subject, the Bureau of Yards and Docks has arranged to have the Naval Research Laboratory undertake a long-term study of creosote and its constituents in an effort to improve wood-preserving treatments. In this particular field, the Naval Civil Engineering Laboratory is experimenting with iron and silica compounds to impregnate wood. While results are not yet conclusive, the methods appear promising.

Firmly convinced that a more thorough knowledge of the life cycle and physiological structure of the various kinds of marine borers would be of great value, the Bureau of Yards and Docks recently engaged Dr. F. G. Walton Smith, Director of the Marine Laboratory of the University of Miami, to investigate this particular avenue of the subject. As a result of this investigation, the Miami Laboratory has successfully developed a technique for raising the borers in the laboratory, one of the most significant developments in the fight against this scourge since the National Research Council first started research in the field in 1922. This development, furthermore, has stimulated the interest of other marine laboratories, although two years ago it was commonly believed that laboratory studies were not practicable. The movement to the laboratory recently enabled Dr. Clapp to observe the method of reproduction of the Teredo. There have been many theories about this, but they were easily disproved by one quite accidental laboratory observation.

To familarize the reader with the various types of borers, perhaps a brief description is in order. Marine borers can be divided generally into two groups, crustaceans, which are related to crabs and lobsters, and mollusks, which are related to clams and oysters. The principal crustacean is the Limnoria, which is widely distributed around the world and extremely destructive. Less well known and less important genera are the Chelura and Sphaeroma. Piles attacked by Limnoria usually neck in at the water line and the mud line.

The mollusks include the Pholads and the Teredinidae. The Pholads are actually small clams about the size of one's thumb. They are not too important since they are abundant only in a few tropical locations. The principal Teredinidae are the Teredo and Bankia. The Bankia is quite similar physically to the Teredo but is usually much larger. Both these species are wormlike and the body exists outside the shell, which is the boring mechanism. The Teredo and Bankia honeycomb timber with their burrows. As far as engineers are concered, the two principal types of marine borers to be kept in mind are the Teredo and the Limnoria.

One important and interesting study has been the observation of the method of entrance into wood of the Teredo larvae. This method is most important since Teredo can enter treated timber in only two ways—

LIMNORIA, a crustacean, grows only 1/8 in. long but does considerable damage and is widely distributed around the world. Other marine borer crustaceans are Chelura and Sphaeroma.

PILES ATTACKED by Limnoria usually neck in at water line and mud line. Limnoria damage is caused by small burrow made by borer about 1/8 in. deep along surface of timber.

against costly marine borers

Chief, Bureau of Yards and Docks, Navy Department, Washington, D.C.

first, as larva, and second as an adult from an adjacent and touching piece of wood. If a structure is properly designed and protected, the chances that an adult Teredo will enter it are very remote; therefore the primary concern should be to prevent the lodgement and growth of the larvae.

The larva must attach itself to wood shortly after it is ejected from the mantle of the female parent. It is ready to attach itself in 36 hours, and if it has not found a suitable home within the next 36 hours it becomes incapable of entering wood and dies. So this second 36-hour period is the most important one in which to attack the Teredo larvae.

Dr. Walton Smith and the Marine Laboratory of the University of Miami have found that the larva is very susceptible to creosote, which undoubtedly has some toxic action which kills or stupefies it. As long as the essential compounds of the creosote are not leached out of the wood by the surrounding sea water, larvae cannot penetrate. What these essential compounds are is still unknown. The results of the work at the Miami Marine Laboratory to date indicate the possibility of developing a test or bio-assay suitable for evaluating wood preservative treatment.

The very interesting results obtained at this laboratory over the past two years show that it is not difficult to obtain physiological data. Studies have been made to show the intensity of borer attack in relation to the velocity of the water currents. These tests disclosed that the Teredo will not attack timber where the current velocity is more than 1.4 knots, and that Limnoria will not attack if this velocity is more than 1.8 knots. It was also found that Teredo larvae are much more active in the dark and that their activity is reduced by the presence of light. Teredo larvae were found to move principally in a vertical direction, which indicates the influence of currents in their propagation.

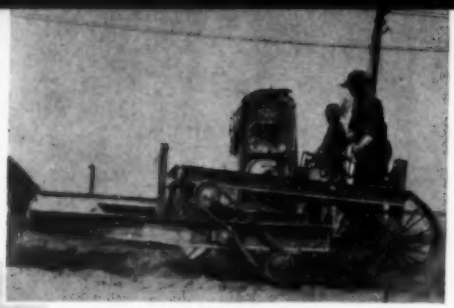
Teredo Bores by Hydrostatic Pressure

A question that has always excited debate is how the soft-bodied Teredo can press its boring shells against the end of its burrow. The Miami Laboratory discovered that Teredo maintain themselves within their burrows, with their boring apparatus in action, by hydrostatic pressure. Normal shipworms, it has been shown, are able to maintain a positive hydrostatic pressure of from 7 to 10 mm of water. Now researchers are trying to discover how the Teredo builds up this pressure.

A start has been made in finding out whether shipworms use the wood they excavate as food. The observations of Dr. F. G. Walton Smith suggest that adult shipworms make use of the wood in which they dwell to maintain their carbohydrate content. Observations and studies of the glycogen or carbohydrate content of adult shipworms indicate that they do make use of the wood which they drill out as a part of their food. It is reported that traces of cellulose have been found in the Teredo's body.

In conclusion, I would like to repeat my two main points on marine borer studies: (1) the work recently done by Dr. F. G. Walton Smith under the sponsorship of the Navy's Bureau of Yards and Docks has demonstrated the feasibility of laboratory work on marine borers, and thus has stimulated interest in such work at other marine biological laboratories; and (2) the revival of interest in this subject over the past two or three years has been accompanied by a healthy tendency to pursue definite and systematic research programs to ascertain basic scientific facts. These two trends make it evident that during the next few years many new facts will be discovered regarding marine borers so that more effective steps can be taken to overcome their ravages, which have challenged engineers for 2,000 years.

(This article is an abstract of the paper presented by Admiral Jelley before the Structural Division at ASCE's Houston Convention.)



ORIGINAL WOOD ROADMIXER (above) was born in 1929 to solve problem of mixing airfield pavement on Alameda Mole. Two modern Model 54 Roadmixers (left) are teamed up to mix average of 600 tons per hour on soil stabilization job for California Division of Highways.

Innovations in methods and equipment are the keys to construction progress

There is no substitute for brains—*use them*

CLYDE W. WOOD, M. ASCE,

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SMALL SUBGRADE TEMPLATE (left), originated by writer in 1924, gave him ideas for large-size machine (below) built for use on Colorado River Aqueduct in 1935. Original subgrade machine rode on 2X4 headers and was drawn along ditch by team of horses. Large machine is seen at work on Metropolitan Water District Canal of 20-ft bottom width and 56-ft top width. Similar equipment is now standard for canal work.

MY EXPERIENCE in mechanical things started on an Iowa farm at the turn of the century. My father had the first mechanized farm in northern Iowa. The usual machines of that day were used for the fields, of course, but we had gadgets to do the chores. Our power plant was a treadmill in which Dad's horses and prize bulls were exercised to pump the water, to shell the corn, to grind the feed, to separate the milk, and to run the churn. At the age of ten I was acquiring a knowledge of practical applied mechanics to go along with a mighty aversion to hard work. This practical knowledge was aided by a little technical knowledge acquired later.

Today my aversion to hard work is dressed up as one of the guiding principles of our organization: "There is no substitute for brains—use them!" This search for brains frequently takes us down to the bottom of the pile. The best consulting engineer on mucking is usually that chap down in the ditch. When you ask him, "How goes it?" his answer may not be printable, and often his suggestions will not be workable, but you will learn what's wrong, and about how to fix it. Out of such an exchange of ideas frequently come great suggestions worth lots of money to the job.

We try to make a game out of this exchange of ideas throughout the organization. I tell my men: "I'm lazy and don't like to work. If you can find some way of doing that job easier and can sit down while you do it, I will sit down and watch you."

This type of game creates great interest and makes every man feel an important part of the job. Dozens of instances could be recited where it has resulted in short cuts that have saved large sums. Out on the Colorado River Aqueduct, a foreman devised a gadget that cost $5.00 to build. It saved one man's wages every day for a hundred days.

A contractor has to be the low bidder on most jobs in order to get them. After nearly 30 years of contracting experience my conclusion is that the job usually is awarded to the chap that has studied it the most carefully, has explored all the available materials, has rightly chosen the needed equipment and its proper use—in other words, has used his brains.

One job I took for the State of California about 1927 was for 13 miles of oiled macadam north of Auburn, where the ground is fairly rocky. This job called for the use of 2-in. headers—something never before asked for on this type of work.

When my bid was read, the common opinion was, "That will be his last job!" If the conventional method of staking down those headers with wooden stakes had been used, every stake hole would have had to be gadded, and the chances are that it would have been my last job. However, we had several white rabbits in mind when we bid on the job. To put down the three lines of headers, totaling 40 miles, I bought the necessary 2x4's, an electric drill, and tons of 10-in. spikes, and literally spiked them to the ground at a nominal cost.

In those days all the screenings—usually two different sizes—for these oiled macadam jobs were hauled out ahead of time, placed in small piles on each side of the road, and after the placing of the base rock, all the men in the county were hired to spread the screenings with No. 2 scoops as the oil was applied. On this job, we originated and used the first chip spreader, hung on the back of the trucks, that was ever used. One day, while applying screenings, one of the visiting highway engineers remarked, "Clyde, you are placing more screenings here with two men than so-and-so is placing with 28 men." In addition, we devised and used a spreader box riding on top of those 2-in. headers that spread the base rock evenly and correctly to depth, thus eliminating a lot of labor in placing the materials. Instead of a loss these ideas added up to a 40-percent profit on the job.

How Wood Roadmixer Was Born

Not always is the result so successful. Many a time we have bid jobs and discovered later that the conventional methods wouldn't fit. In order to keep from losing our shirts we had to do something about it after the job was started. This is how the present Wood Roadmixer was born.

Back in 1929 an engineer friend asked me to bid on a small air strip for a private owner at Alameda. He was one of the originators of road-mix construction with blades in the State of Nevada, and had had some excellent results mixing hot oil with the hot sands of that state. It was his plan to mix this air strip in the same way. Knowing nothing about that type of work, I agreed to do the job with that kind of a specification, but soon discovered that mixing hot oil with the hot sands in Nevada was a different matter from mixing hot oil with the damp, cold sands on the Alameda Mole. At Alameda the oil congealed as rapidly as it hit the sand, and all that I had after turning it a hundred times with blades, disk harrows, and every other tool I could lay my hands on, was a lot of lumps.

SPECIAL FORM 200 ft long, developed for use on Freda Siphon of Colorado River Aqueduct in 1935, made possible progress of 200 lin ft of pipe per 24-hour day. Whole form was moved ahead by cable attached to tractor on bank.

It looked as if this little $10,000 job had turned into a disastrous project. One day, while walking across the air strip with a stick in my hand, I started hitting those aggravating lumps and found that they would fall apart when struck with this club. So the simple solution appeared. All that was necessary was plenty of clubs. Returning to my equipment yard in Stockton, I took a shaft and a set of paddles out of a standard asphalt mixer and mounted them in a frame with a 60-hp engine. Thus was born our first mixer. With these "clubs" this little job was successfully completed.

At that moment the air strip was sold to the Curtis Wright people and my $10,000 contract became a profitable $100,000 job—with my new "club" mixer. The principles of the original machine have been incorporated in a heavy-duty pulverizer, used for revamping and salvaging old oil pavements. Our present continuous-mixer type of roadmixer was first used commercially on the roads of the Colorado River Aqueduct of Los Angeles, and since then has gone all over the world.

My experiences with the lining of irrigation canals started in 1920 when I was an irrigation engineer in the northern part of California. The only methods used at that time were those developed by the Swedish ranchers on the Turlock Irrigation District, who thoroughly enjoyed lots of hard work. Their canal jobs were always done the hard way. The ditches were trimmed by hand. The concrete was mixed in a one-sack mixer, wheeled in a wheelbarrow 100 to 200 ft, and placed by hand.

About 1924, after I had become a contractor and had obtained some of this kind of work, I decided that their methods were too hard, so I evolved my first subgrade template. It rode on 2×4-in. headers, drawn down the bottom of a ditch with a team of horses and a block and tackle to shape the ditch. Another such template was a slip form from which the concrete was placed. I substituted a two-sack mixer and two-wheel buggies for the one-sack mixer and wheelbarrows used by my Swedish friends. The wooden slip form didn't work too well. We ended up by placing the concrete the old-fashioned way. However, it gave me ideas.

In 1935, after ten years of waiting, I got a canal lining job on the Colorado River Aqueduct of sufficient size to warrant the investment to carry out those ideas. With the approval of Construction Engineer J. L. Burkholder, M. ASCE, I spent my money to construct the slip-form equipment I wanted. Not only did it work, but I had the satisfaction of seeing most of the contractors who got other sections of the canal copy my system. Since then this method has become standard practice. It has become the specified method of lining canals in our own nation and in various parts of the world.

Another interesting experience was the development of the forms used to construct the Freda Siphon on the Colorado River Aqueduct. This structure consisted of cast-in-place pipe over 15,000 ft in length and of 12-ft 4-in. inside diameter. We used 200 lin ft of forms for this job, and after the crew became organized, progress averaged 200 lin ft of pipe per 24-hour day. This speed was made possible by the arrangement of the forms. The outside forms were mounted on a rail with a wheel and a hydraulic jack at 10-ft intervals on each side so that when it came time to

CAREFUL STUDY of form design paid dividends in construction of pontons for unique Lake Washington ponton bridge at Seattle in 1939. Twenty-five pontons for 1½-mile-long bridge were built with one set of specially designed wooden forms, here seen being assembled in yard.

move the form, a man could walk down each side of the structure and jack the form approximately 3 in. to loosen it. Then a cable attached to a tractor moved the whole 200-ft length quickly to its next position.

The inside forms were telescopic, with sufficient extra bottom pieces supported on a concrete block with adjusting cones placed ahead of our actual moving operation, so that the inside forms could be moved ahead in 40-ft sections. With two concrete pavers, the average pouring time for this 400-cu yd section was approximately 5 hours—for which the pouring crew received a full day's pay. Inside stripping time was reduced to 12 hours, making it possible to complete a cycle every 24 hours without difficulty. The time and study spent on producing these forms paid handsome dividends.

One of the unique structures of its type in the nation, which I had a part in building, is the ponton bridge across Lake Washington at Seattle. This structure is approximately $1^1/_2$ miles long, contains 25 pontons each 350 ft long and each containing 96 cells, roughly 14 ft square and 14 ft deep. All the pontons were built with one set of wooden forms. It is easy enough to build a square form, but not always so easy to strip it without wrecking it—let alone stripping it 25 times without wrecking it. In this case stripping was facilitated by a diagonal corner piece so constructed that when the corner braces were removed the whole inside form collapsed, after which the diagonal corner piece was removed. This careful form study again paid handsome dividends, not only in the time of completion, but in the over-all cost.

One rather recent experience was not successful—the belt conveyor built for the Ridge Route highway widening job, where a half-million yards of excavation had to be moved across a heavy flow of traffic. The machine consisted of a 48-in. belt conveyor with a 48-in. feeder belt and feeder—all on wheels so as to move along with the job. Because of our inability to feed the belt economically, or to get sufficient trucks to take the material away from it, shortly after starting it up we abandoned the idea of using it.

For six months thereafter almost daily inquiries were received about its operation, as it got publicity in all the American publications and in many foreign ones. The idea appealed to others even though it proved to be a quite substantial flop for us. However, we were able to retrieve our investment on this equipment by adapting it to a highway job north of Ventura, where it moved over half a million yards of material under the Southern Pacific Railroad tracks and over the highway without interrupting train or highway traffic. There it was set up in a permanent position, so that we were able to feed the belt and take the material away from the other end effectively.

Recently we finished a jetty for the Army Engineers at San Diego and received quite a writeup in one of the local magazines about the "Joe Magee" boom used on the rock-placing crane. This boom came into use because of the necessity of either paying $75,000 for a larger crane, or renting one, or in some way adapting my own crane so that it could handle heavy rock to the satisfaction of the engineers. Half the concrete dams in America have been built with hammerhead cranes, so I could think of no reason against converting my heavy-duty crane into a hammerhead and thus obtaining sufficient counterbalance to enable it to do the job. This conversion was accomplished at a cost of less than $1,000. It saved at least $3,000 per month for a year.

The job superintendent, the placing foreman, the crane operator, and even the Government Division Engineer argued at great length that it could not be done—because it had never been done before. Behind most of their arguments was the fear that it might be a failure and thus cause them to be laughed at by other construction stiffs. More of the ideas in the minds of many men would be used if they thought they could afford a failure. Progress is only made when somebody is willing to make mistakes and so to point out what ought *not* to be done.

Barbs for the Engineers

This unwillingness to adopt innovations is not limited to construction men. Engineers likewise will confess that they often have a great deal of hesitancy about venturing out on a limb. We need more venturesome individuals in the engineering profession. One direction in which pioneering would pay large dividends is in the field of standardization. Simple standardization of the dimensions and sizes of beams and fillets, so that contractors could afford to equip themselves with steel forms, would ultimately effect savings of millions of dollars to clients, and ultimately of course to the consumer, which includes all of us.

On our desert work on the Colorado Aqueduct for the Metropolitan Water District we used steel forms almost exclusively, partly because of the standardization of structures involved, but chiefly because these forms could be stripped in a reasonable time, thus keeping the number of forms required within the limits necessary to give the contractors a profit. The stripping time for a 10-ft span was set by the engineers at 30 hours—or at a developed concrete strength of 750 psi. The 16-ft unreinforced concrete arches were stripped in 16 hours. Excellent workmanship, and great savings to the District and the contractors, resulted.

While the decision to use this procedure was based on an old specification formula originally pioneered by the Flood Control Engineers of Los Angeles County back in the 1920's, of three hours per foot of span, we are still being asked by many engineers to hold the forms in a 2-ft-square culvert for as long as 14 days—which makes it uneconomical for contractors to do other than they have done for the last thirty years, namely, to build their forms out of wood and add the extra cost to their bids.

Curing time of concrete has received a lot of study, but in spite of the fact that it was definitely established in the 1920's that little or no hydration takes place after the first 72 hours, much money is still being spent on curing for from 7 to 14 days. I recently was compelled to hold forms on a 15-ft arch for 14 days, which meant that my form costs were triple those actually needed to produce an equally good structure.

Good construction practice consists of intelligent team work and cooperation between engineers and contractors. This means, for every job, a thorough and complete study by the design engineer for economy and efficiency. Such a study will encourage the construction engineers and contractors to devise innovations that will permit execution of the design with all the efficiency and economy possible. Engineers must not only be well trained men, but they must also have confidence in their own ability and a willingness to take a chance for the sake of advancing the art of construction, which today represents such a large part of the nation's economy.

During thirty years of construction experience, I have seen enormous advances in the art of construction. We can conclude that a great deal of brains was used in this development. The next thirty years will see even greater developments than we have witnessed to date. There is no substitute for brains—don't, please don't, be afraid to use them.

What constitutes adequacy of construction?

LAW

WALTER D. SADLER, M. ASCE, Civil Engineer and Attorney at Law, Ann Arbor, Mich.

"TO THE COMPLETE satisfaction of the owner" is a phrase used occasionally in contracts as a test of the acceptability of construction work. This phrase is something of a catch-all, and its vagueness and all-inclusiveness may be a source of discord and litigation. "Satisfaction" is a rather flexible word and can cause trouble when an owner alleges lack of it as a pretext for non-payment, or when a contractor tries to get away with mediocre workmanship or materials.

There is also the case where an owner honestly but mistakenly anticipates a standard of accomplishment higher than can reasonably be provided by an experienced contractor. The use of a general term like "satisfaction" is unfortunate, particularly if a prejudiced owner is made the sole judge of the acceptability of the work.

To assist in the resolution of this problem the law recognizes two classes of contractual subject matter: (*a*) fancy, taste and judgment; and (*b*) operative and mechanical fitness.

Fancy, Taste and Judgment

The subject matter of the first class of contracts is personal and is based on the "fancy, taste and judgment" of the buyer. The painting of a portrait is a case in point. When an artist has contracted to paint a portrait to the "entire satisfaction of the buyer," the buyer is not obligated to accept the portrait if he proves his dissatisfaction by alleging "wrong colored eyes, wrong colored suit, a general collapsed appearance, and unnatural shadows." The purpose of such evidence is to prove that the buyer is not satisfied; it is not intended as a justification for his dissatisfaction. As long as he is honestly dissatisfied, the buyer can refuse the portrait on the ground of "fancy, taste or judgment." Where there is no recognized standard of performance, the courts will enforce a contractual provision that "the owner or buyer shall be the sole judge of satisfactory compliance."

Operative and Mechanical Fitness

Building work, on the other hand, is treated as impersonal, and the "satisfaction of the owner" clause does not alter the requirements of the specifications. It only means that the work should be honestly good, as measured by the average man's ideas. The courts interpret the specifications as requiring an honest compliance and an honest acceptance. In plain language, the owner should not utilize the clause "to the complete satisfaction of the owner" as a pretext to avoid his responsibilities.

A proper set of specifications anticipates all contingencies, and includes definite requirements which have long been accepted and are easily applied. The adequacy of performance is measured by these specifications. The difficulty arises when the writer of construction specifications tacks on that troublesome clause, "and to the entire satisfaction of the owner." The courts say, "The specifications were written for a purpose, and must be so considered." This means that the accepted engineering standards, as applied to the controverted specifications, must be evaluated by the jury, or court. If the jury or court finds that the contractor has complied with the specifications, the incidental dissatisfaction of the owner is immaterial.

Occasionally contracts are drafted with apparently iron-clad insurance that the owner is to be the sole and final judge of the acceptability of the work. Such a provision usually states that the owner has the unquestioned right to breach the contract at will. An "owner as sole judge" clause appeared in the contract in each of the three following cases:

1. A tenant who had prepared a piece of land and planted a crop was ejected by the landlord on the ground that his farming practices were unsatisfactory.

2. A salesman working on a commission basis had furnished his own car and worked up sales to the point of signature when he was transferred to another state or discharged.

3. An efficiency expert who had been retained on the basis of a percentage of the monetary savings realized by his recommendations, was refused admittance to the plant by the owner. The legal issue was whether the expert could force the owner to disclose which of his suggestions had been adopted, and what savings had been effected thereby.

In each of these cases the courts decided against breach of contract on the grounds of a vested interest. To condone such an arbitrary breach would have caused an injustice. Thus the tenant farmer had a vested interest in the growing crop, and the right to receive compensation for his efforts; the salesman could collect payment for his contribution towards sales; and the efficiency expert was permitted to subpoena the pertinent operating statistics.

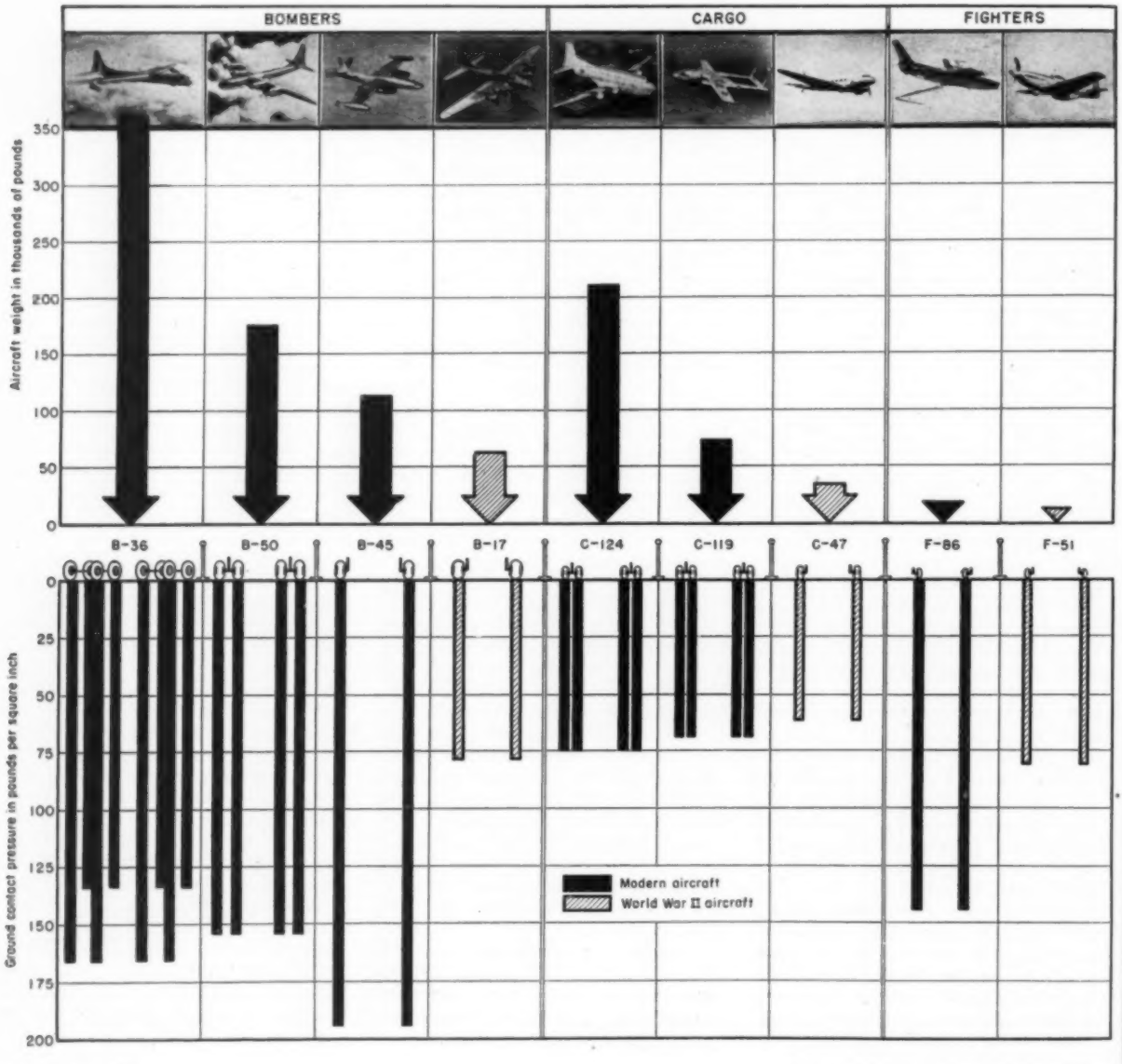
Courts Loathe to Enforce Whims

The courts are so reluctant to enforce "the sole decision of the owner" clause that they scan the facts most carefully for any loopholes. Where a contract has required the owner to give a written notice of dissatisfaction, the court has refused to enforce positive proof of oral notice.

On a large building project the contracts and specifications may be prepared and signed a year before the work is completed and this period of time may be increased by delayed decisions regarding machinery and equipment installation. Unfortunately, it often is necessary to use general terms such as "good workmanship," "satisfactory credit rating," "expeditious scheduling," and "cooperative attitude toward other contractors and the owner." These terms are usable as such. The objection arises where the owner personally is given the sole decision as to satisfactory compliance by the contractor; or where the general contractor is made the sole judge of performance by a subcontractor. Such arbitrary authority can be abused, and the courts are loathe to enforce the whims of the capricious.

Modern military

FIG. 1. HEAVIER gross loads and higher contact pressures of modern military aircraft (below), have made runways of World War II obsolete in many cases. In addition, blasts of jet engines and deteriorating effect of jet-engine fuel have posed serious problems to pavement designers. B-45 (above, left) with ground contact pressure of 195 psi, is typical of new look in military planes.



MAJ. GEN. J. B. NEWMAN AND LT. COL. H. E. BROWN
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aircraft change airfield design concepts

SINCE World War II, the design of military aircraft has advanced at a rapid pace. Planes have become heavier and faster. They fly farther. These factors plus the new types of engines and fuels have all combined to make the military airfields of only five years ago obsolete.

The contact pressures of the World War II aircraft shown in Fig. 1 average about 75 psi. The two modern cargo aircraft, the C-119 and the C-124, use approximately the same tire pressure. However, the pressure of the F-86 is 145 psi, an increase of almost 100 percent. The tires on the B-50 and the rear tires of the twin tandem gears on the B-36 have pressures of 167 psi. Note that the contact pressure of the B-45 is 196 psi, or almost $2^1/_2$ times that of the B-17.

THE REASONS why high contact pressures and heavy total loads result in serious pavement design problems are shown pictorially in Fig. 2, which explains the theory behind some of the phenomena encountered in design. The shear stress is of course the true strength characteristic of a material. The exact position of the curves in Fig. 2 may be subject to some question. However, the chart does give a fairly acceptable picture of the relative stresses which have to be resisted by the pavement as total loads and contact pressures vary.

Note the two curves representing a 200-psi contact pressure. The upper curve is for a total load of 10,000 lb and the lower for a load of 50,000 lb. The significant point to remember from these two curves is that the magnitude of the maximum shear stress is the same in both instances, but the depth at which this stress occurs is greater for the larger load. In terms of runway pavements, this means that for a given contact pressure the required quality of the pavement is the same, but that as loads increase the material must be provided to a greater depth. The word "pavement" as used herein refers to the total prepared surface placed over the subgrade and includes both base course and unpaved surface.

In the three 50,000-lb curves, the maximum shear stress of the 200-psi contact pressure curve is 62 psi, or twice the maximum shear stress imposed by the same load at 100-psi contact pressure. Similarly the maximum shear stress for the 150-psi curve is 50 percent greater than that for the 100-psi curve. The significant point is that the relative increase in maximum shear stress is of the same order as the relative increase in contact pressure. In other words, the maximum shear stress is directly proportional to, and varies as, the contact pressure. In terms of pavement design this means that even though the total load is the same for each loaded area, the structural quality of the pavement material required for a 200-psi contact pressure is twice that necessary for a 100-psi contact pressure, at least in so far as the ability to resist shearing stresses is concerned. The requirement for such high-quality pavement will materially lengthen the time of construction of combat fields.

To summarize, high contact pressures require both thicker pavements and higher quality materials, while heavier loads require only thicker pavements.

Most significant in the program to reduce contact pressures is the development of the multiple-tire landing gear such as the twin-tired gear on the C-54 and B-29 and twin-tandem gear on the B-36. In the twin-tandem type each gear has four tires spaced 31 in. center to center laterally and 60 in. center to center longitudinally. Where the pavement is thin, flexible, and on a good subgrade, the wheels are far enough apart so that they act independently in so far as the pavement is concerned. However, where there is a deep pavement on a poor subgrade the stresses imposed in the ground by the separate wheels overlap, and if the pavement is deep enough the effect is equivalent to a single wheel carrying the entire load. The inflation pressure of the front tires on this twin-tandem gear is 134 psi, while that of the rear tires is 167 psi. The gear was designed so that the rear tires would carry more weight than the front tires. This weight distribution minimizes overloading of the front pair of wheels when the brakes are applied, and facilitates steering of the aircraft on the ground.

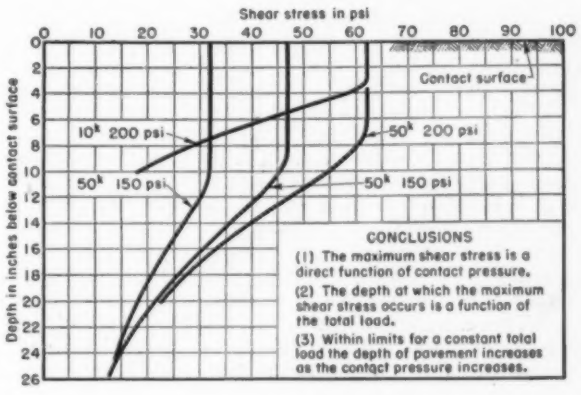


FIG. 2

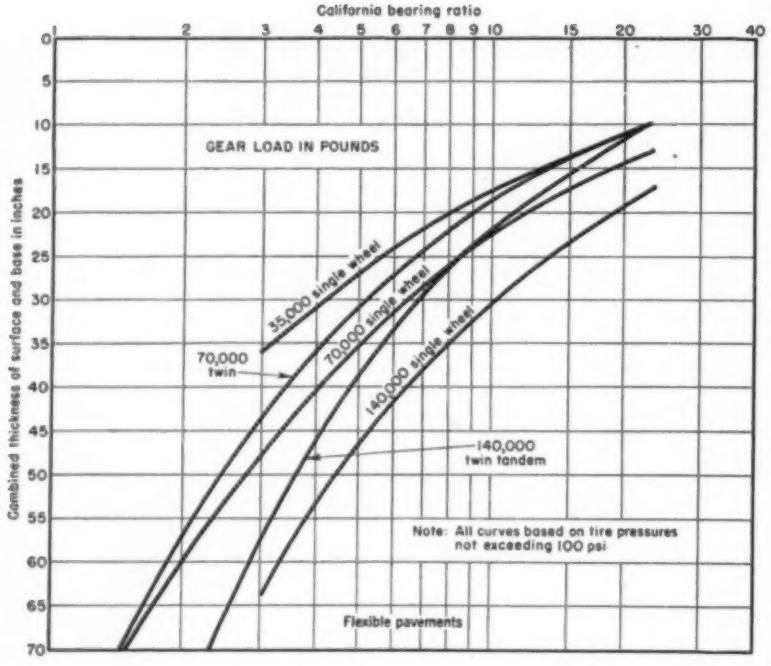


FIG. 3

PAVEMENT DESIGN curves for flexible pavements are shown in Fig. 3. This chart illustrates the equivalent single-wheel loadings of the two most widely used multiple-tire gear—the twin or two-wheeled gear and the twin-tandem or four-wheeled gear. The equivalent single-wheel load is defined as the load carried by a single tire that would require the same pavement as the multiple-tire gear. The curves are for bituminous surfaced pavements.

It is to be noted in Fig. 3 that the twin and twin-tandem curves converge and join the 35,000-lb single-wheel curve at a subgrade CBR of about 23 and a total pavement thickness of 10 in. Thus for thin flexible pavements on good subgrades the wheels of these multiple-wheeled gear act independently of each other, and the equivalent single-wheel load has the same value as the load actually carried on each of the four tires of the gear.

The extreme condition at the lower left of the chart is also noteworthy. Here we have a deep pavement on very poor subgrade material. Here the 70,000-lb twin curve converges into the 70,000-lb single curve. By actual test, it has been shown that at a depth of 75 in. the equivalent single-wheel load of a 70,000-lb twin-tire gear is 70,000 lb. Under these extreme conditions the advantages of the twin gear are lost in so far as the total pavement thickness is concerned. Similarly, the 140,000-lb twin-tandem curve would ultimately coincide with the 140,000-lb single-wheel curve.

The reader is reminded that these curves are based on tire pressures not exceeding 100 psi and do not reflect the high-quality pavement requirements necessitated by high tire pressures. For example, the first B-36 was supported by single 110-in-dia tires at a pressure of 100 psi. The saving in construction effort resulting from the adoption of the twin-tandem gear on this airplane was partially offset by the increase in pressure to about 150 psi.

FIGURE 4 gives the same type of data for rigid pavement as is shown in Fig. 3 for flexible pavement. The subgrade soil modulus, the abscissa, like the CBR, is an index of the structural strength of the soil. The soil modulus is determined by applying a load of 10 psi to a circular plate of 30 in. in diameter and accurately measuring the deflection of the subgrade. The applied pressure, 10 psi, is then divided by the deflection in inches. The result is the soil modulus K in psi per inch. The high soil modulus values to the right represent good soils, such as sandy or gravelly, and the low values to the left represent poor soils, such as silty or clay.

The left scale of the chart represents total thickness of pavement required in inches. It becomes apparent that with rigid pavements the value of the soil modulus has very little effect on the pavement thickness required. The equivalent single-wheel loading for the 70,000-lb twin-

THE BEARING capacities that could be realized from a flexible pavement through the use of various configurations of multiple-tire gear are illustrated in Fig. 5. This chart is prepared for a hypothetical runway composed of a deep 70-in. flexible pavement on a very poor frost-susceptible subgrade. Bearing capacity curves are shown for 100 and 200-psi contact pressures. The pavement is assumed to be of sufficient quality to withstand the shear stresses resulting from high contact pressures. Four twin-tandem curves are shown with an A distance center to center of sets of twin wheels equal to 40, 60, 80 and 120 in.

The bottom curve, for twin gear (A = 0 in.), originates at the single-wheel gear load value of 150,000 lb. This point, prominently marked at the left of the chart, is the single-wheel gear

TRACK-TYPE landing gear is an entirely new type now undergoing extensive experimentation in an effort to find ways of distributing the increased weights of modern aircraft. This gear consists of continuous flexible belts supported on bogies. It promises *partial* alleviation of the pavement construction task, especially with the flexible-type pavements normally used in a theater of opera-

tire gear on rigid pavements is about 61,000 lb regardless of the type of subgrade. It is to be noted that for flexible pavements the equivalent loading for the 70,000-lb twin gear varies from 35,000 lb for good subgrades to 70,000 lb for poor subgrades.

This difference in the action of multiple-tire loads on flexible and rigid pavements is due to the difference in the relative rigidity of the pavement and the subgrade. On flexible pavements, where relatively large deformations are permissible, the wheel load is transmitted directly to the subsoil and is therefore more dependent on its strength. The strength of a rigid pavement, on the other hand, is controlled by the flexural strength of the concrete and consequently the load is spread over a wide area before it reaches the subgrade. Thus for a constant flexural strength, the saving in rigid pavements through the use of multiple-tire gear is constant for all subgrades.

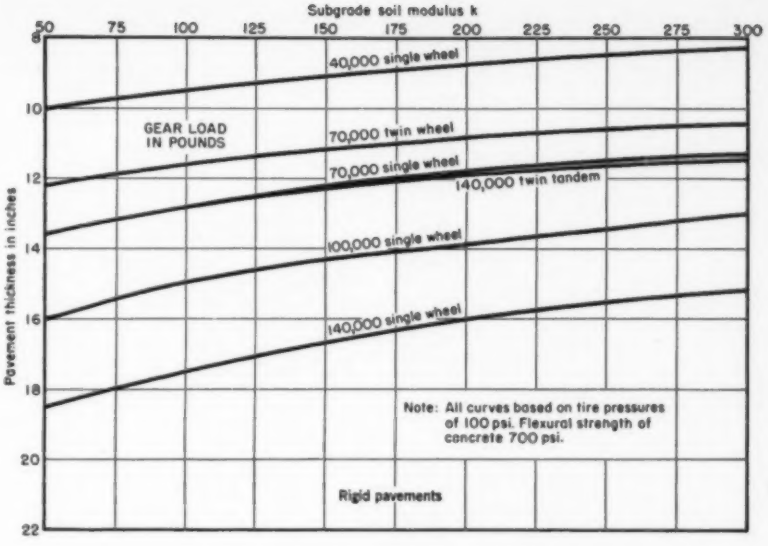


FIG. 4

design point for the pavement. Note the position of the 31 × 60-in. B-36 gear. This pavement could carry a B-36 grossing 500,000 lb. The chart illustrates one of the effects of high contact pressures presented previously. You will recall that for deep pavements the maximum shear stresses and vertical pressures for various contact pressures converged upon each other (Fig. 2). In this example, where we have a very deep pavement, the contact pressure makes very little difference in the total permissible landing-gear load, provided the material of the upper base course is of sufficiently high quality. The 100 and 200-psi curves are only separated at small values of B shown on the left of the chart. The 300-psi curve was so close to the 200-psi curve that it could not be plotted separately.

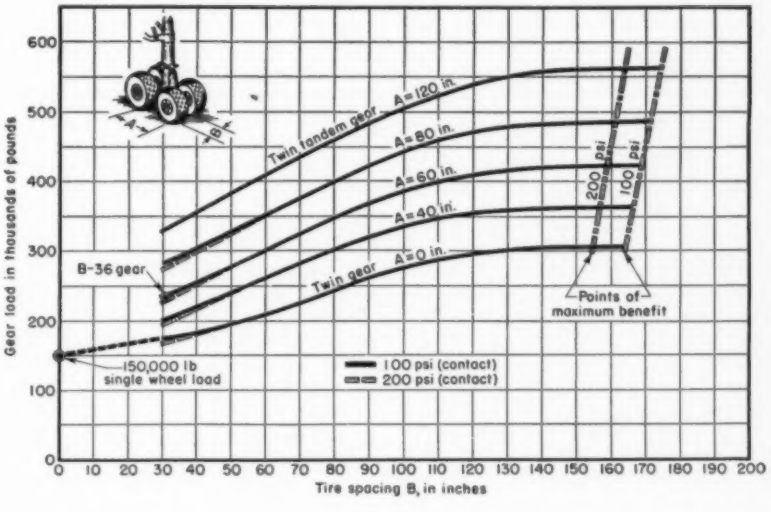


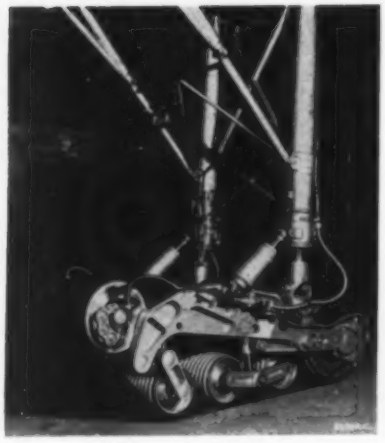
FIG. 5

TRACK TYPE GEAR

tions. The advantage of this type of gear is that lower average contact pressures can be obtained for a fixed volume than can be obtained even by multiple-tire-type landing gear. Track-type gear is not necessarily superior to tire gear at the same contact pressures; its potential superiority is due to the low contact pressures that can be developed.

Track-type landing gear has certain disadvantages. The rolling resistance is greater and therefore the take-off run is lengthened; loose material tends to accumulate in the bogies; and maintenance and spare-parts problems are accentuated. The total weight of each of the track gears currently in use on aircraft (see photographs on next page) is greater than that of its tire-gear counterpart by the following amounts: the C-82, 1,320 lb; the B-50, 4,550 lb; and the B-36, 4,390 lb.

This added weight will have to be balanced by reduced bomb or fuel loads. However, if the use of track gear makes it possible to push airfields closer to the enemy, the resulting fuel saving may more than compensate for the slight increase in basic weight. It is anticipated that future refinements in design will overcome



TRACK-TYPE LANDING GEAR is one method of distributing wheel loads. This type of gear, however, lengthens take-off runs and is considerably heavier than wheel type.

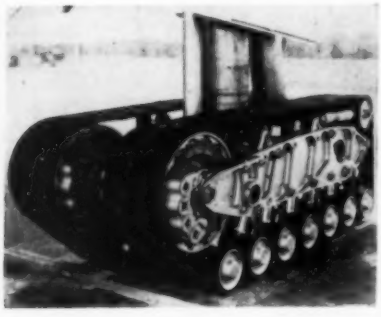


TABLE I. GROUND CONTACT PRESSURES FOR TRACK-TYPE GEAR COMPARED WITH THOSE FOR PNEUMATIC-TIRE GEAR

Aircraft	Gross Weight, Lb	Ground Contact Pressure, Psi	
		Track	Tires
C-82	54,000	27	63
B-50	170,000	43	144
B-36	358,000	52	153

some of the present faults of the track gear.

A comparison of the average ground contact pressures for the C-82, B-50, and B-36, with track-type gear and with tire gear, is given in Table I. Since the contact pressures for the track gear are lower, it follows that for normal subgrades the total pavement thickness will be decreased with this type of gear. Of even greater importance is the reduction made possible in the quality of the pavement surface material, since the pavement will not have to withstand the high shearing stresses imposed by the high-pressure tire. However, further modifications of existing tire-type gear, together with the development of lower-pressure tires, may accomplish results equivalent to those obtained by the track gear.

DEVELOPMENT OF JET ENGINE has raised problems that are entirely new to the pavement designer. These problems can be divided into three categories: (1) effect of spillage of jet fuel, (2) force of the blast, and (3) heat of the blast.

During the normal operation of a jet plane, liquid fuel is expelled and falls on the pavement surface. The fuel used in early models was basically kerosene, which has a solvent action on asphaltic pavements, softening the asphalt binder, particularly in the upper layers, and creating a tacky and slick surface condition. The pavement is thus made more susceptible to the effects of traffic and of the heat and blast of the exhaust.

Coal tar, being relatively insoluble by petroleum products, is a satisfactory binder as far as resistance to the softening caused by fuel spillage is concerned, but it is more sensitive to temperature changes and consequently is softened by the heat of the jet blast. Synthetic rubber compounds promise a solution to these pavement design problems but their expense is generally prohibitive.

The USAF has recently adopted a new type of jet fuel which is basically gasoline and consequently more volatile. This fuel, it is hoped, will simplify the pavement design problems resulting from the use of jet planes.

THE RUNWAY LENGTHS required have been greatly increased by the increased weight of aircraft and the extensive use of jet engines. Also there is a wide variation in the runway lengths needed for different types of aircraft. For example, at sea level, the ground run of the F-84 is about $2^1/_2$ times that of the F-51. These two factors of *increased* runway lengths and *varying* runway lengths for different aircraft have resulted in a change of Air Force policy as to the methods used in determining the runway length for a specific base.

Instead of past practices, the USAF has established factors of safety to be applied to the take-off or landing ground-run characteristics of the aircraft for which the field is being constructed. These factors and the ground-run characteristics can be obtained from the Handbook of Flight Operating Instructions published for each aircraft.

Three standards of construction have been established for airfields in theaters of operation—emergency, minimum operational, and full operational. Runway lengths are designed to provide ground-run safety factors of 25, 50 and 75 percent respectively. It is envisaged that the 50 percent factor or the "minimum operational" standard will be normal in theaters of operation, and war planning is generally based on this requirement. The standard applicable to any particular locality will depend on the exigencies of the situation, the use to which the field will be put, the degree of maintenance anticipated, and the risk that may be justified.

A few salient facts in connection with this new, more rational method of determining runway lengths are the following:

1. Fixed basic runway lengths are no longer used, except for broad planning purposes.
2. Fixed percentage increases to correct for elevation or temperatures are not required.
3. A constant safety factor in runway length is provided for world-wide use for the same types of construction, regardless of operating weight of aircraft, or elevation or temperature of the airfield.
4. The total distance required by an aircraft to clear a 50-ft obstacle is now used only as an indication of the glide-angle requirement.

This method of determining runway lengths will require the construction engineer to make a more detailed analysis of the various factors which affect the take-off and landing characteristics of aircraft. This slight additional effort by the engineer planner will be repayed many times over, however, in minimizing the danger of overdesign or underdesign which is inevitable in any construction project.

Thus it is evident that modern aircraft have presented to engineers problems which were non-existent during the last war. A reasonable solution to these problems can only be obtained through the closely coordinated efforts of the aircraft manufacturer, the airfield designer, and the military construction force.

COMPLETED Port Authority Bus Terminal has 3-acre parking area on roof. Terminal, fitted in between 40th and 41st Streets and Eighth and Ninth Avenues, in New York's teeming West Side, handles nearly 2,400 buses and 130,000 passengers daily. Facilities are also provided for long-haul bus services. Lincoln Tunnel entrance is in background.

JOHN M. KYLE, Chief Engineer,
Port of New York Authority, New York, N.Y.

Block-size bus terminal alleviates traffic congestion in New York

THE NEW $24,000,000 Port Authority Bus Terminal is fulfilling its promise to take thousands of bus movements off the congested streets on the West Side of New York City. Opened for business on December 15, 1950, the 800×200-ft structure, the world's largest bus terminal, has removed from mid-Manhattan streets some 4,800 movements made by nearly 2,400 intercity buses each day and has accommodated 130,000 daily commuter and long-distance bus travelers.

About 2,200 of the buses never use city streets at all, as they travel by overhead ramps between the terminal and the Lincoln Tunnel Plazas. About half of the remainder come no closer to the midtown area than 115 ft east of Ninth Avenue, where the long-distance buses enter and leave the terminal. The balance, which use the George Washington Bridge and the Holland Tunnel in crossing the Hudson River, enter the overhead terminal ramps at 40th Street and Tenth Avenue. Taxicabs use a straight road between the 40th Street entrance and the 41st Street exit.

The terminal building has four levels, plus the roof which provides three acres of parking space for more than 450 cars. The lower level is devoted to long-haul buses, the second level is the main concourse, the third is the suburban concourse, and the fourth is the suburban bus level.

New Policy Paves Way for Terminal

After the New Jersey and New York Legislatures passed bills authorizing the Port of New York Authority to proceed with the bus terminal, the City of New York established the policy, on January 30, 1947, that erection of any new bus terminal or the permanent enlargement or extension of an existing bus terminal east of Eighth Avenue would not be approved. With this policy established, the necessary land was acquired for the present terminal and demolition of existing structures began May 3, 1948. Meanwhile the Port Authority had arranged for the relocation of 599 families living on the site. Part of the relocation program included rehabilitation and modernization of 14 tenement houses in Manhattan. Ground was broken on January 27, 1949, the first steel went up on November 26, 1949, and the steel erection was completed March 9, 1950. Dedicated on December 14, 1950, the terminal was opened for business the following day.

The more than 9,000 tons of structural steel required for the 614,437 sq ft of floor area, most of it in individual beams, makes the unit tonnage much greater than that in the conventional New York skyscraper. In addition, 2,100 tons of reinforcing steel, 25,000 cu yd of concrete, and 2,500,000 bricks were used. The building has brick exterior walls and white marble exterior trim. Interior walls of the main and suburban concourses are finished in Hauteville marble, other walls in structural glazed tile. The floors are made of a light-aggregate concrete and finished in terrazzo. The floors of the roof and the two bus levels, of reinforced concrete, are designed to carry a live load equivalent to the largest bus contemplated by the manufacturers. (See Fig. 1.)

EXCAVATION for 800x200-ft structure began January 27, 1949, and first steel was put up on November 26, 1949. Relocation of 599 families previously living within area of site required rehabilitation of 14 Manhattan tenement houses.

BUILDING was erected in four sections to reduce size of labor gangs to practical limits. Steel was erected from ground by crawler cranes. Structure is heavier than average for its floor area. Roof and two bus loading floors are reinforced concrete slab design.

All forms were hung from the structural steel beams by special form hangers designed by Richmond Screw Anchor Co. For ceilings less than 15 ft high, forms were stripped and lowered from horse-scaffolds resting on the floor. For ceilings over 15 ft high, permanent scaffolds hung from rods attached to the structural steel were used to erect and strip the forms. Those scaffolds were kept in place for later use in finishing concrete surfaces. Concrete work was completed within 5 months.

The possibility of erecting a mixing plant at the site was seriously considered. However, the time required to erect such a plant was too great, and the concrete was purchased from Metropolitan Sand and Gravel Co. Mixer trucks of $5^1/_2$- to $8^1/_2$-cu yd capacity were used to transport the concrete. All concrete for structural slabs, fills and finishes was delivered by 5 hoist towers with $1^1/_2$-cu yd-capacity buckets, spaced about 150 ft apart along 41st Street. During peak operation, 500 cu yd of concrete were poured in a day.

Sloping Floors Reduce Ramp Grades

A unique feature of the terminal is that each of the four levels and the roof are in part slightly sloped down to minimize the grade along the elevated ramps between the Lincoln Tunnel Plazas and the third and roof levels of the terminal. The average ramp grade is 3.5 deg, with a maximum of 7.5 deg on the access ramp to the parking roof. To provide space for the four required levels within this height limitation, the Port Authority took advantage of the east-to-west (Eighth to Ninth Avenue) sloping street grade. This slope was reversed in the lower or long-distance level to provide a street grade entrance at the Ninth Avenue end of the terminal, and a basement level at the Eighth Avenue end. The main concourse is at street level at the Eighth Avenue, and at mezzanine level at Ninth Avenue. From about the center of the third and fourth levels and the roof a slight downward slope is provided toward the west.

A subway mezzanine connected by ramp directly with Eighth Avenue Subway is located between the long-distance bus level and the main concourse. The Times Square subway station served by other subway lines is only a block away and can be reached by an underground passage. Crosstown surface transportation on 42nd Street likewise is only a block from the terminal.

Ice-free operation of the 1,500-ft exit ramp and the 1,540-ft entrance ramp, as well as the roof parking ramp is assured at all times by a radiant heating system embedded in the concrete roadway. The under part of the roadway is protected with insulating board. The six miles of pipe coils are filled with Sovaloid, and heat comes from the New York Steam Co. The system was designed to melt 1 in. of snow per hour over a total area of more than $1^1/_2$ acres. A temperature range of 135 to 175 deg F is maintained by automatic thermocouples as well as manual controls. The radiant heating coils were prefabricated in 50-ft lengths, and site welded.

Costing approximately $3,600,000, the ramps consist of reinforced concrete slabs on steel girders supported by 55 steel and 28 concrete columns. About 2,180 tons of steel and 2,700 cu yd of concrete went into their construction and they are designed for the same loading as the terminal (Fig. 1). The use of insulating board beneath the slab eliminated the necessity for special forms, as the concrete was poured directly on the board. The ramps clear Tenth Avenue by 14 ft and Ninth Avenue by 28 ft.

Lower Floors Are Air Conditioned

To assure the year-round comfort of bus terminal users, the waiting room on the main concourse is air conditioned, as well as all offices and dining, shopping and recreational areas. At all times air is exhausted from the long-haul bus level by two fans, each rated at 40 hp and 370 rpm, which remove 164,700 cu ft of air per min. Air on the suburban bus level, which is open at the sides, is exhausted by six axial-flow fans each rated at 10 hp and 450 rpm, and capable of exhausting 100,000 cfm. Fans also keep fresh air circulating on the long-distance bus level. On the roof are six 20-ft-high brick ventilation towers and two penthouses devoted to mechanical utilities, roof-parking waiting room, emergency equipment, and fan ventilation.

A striking feature of the terminal is the 31 moving stairs, said by The Peelle Co., to be the largest initial installation of moving stairs in the nation. The amount of shop fabrication on the escalators was unusual. Each unit was completely shop fabricated minus only the driving head. Each 50-ft unit was transported to the site from Coffeeville, Kans., by truck and lifted into position by means of block-and-fall tackles. Driving heads were then attached.

Likewise the 177 public telephones are said by the New York Telephone Co. to be the largest single installation of public telephones in the history of

STIFF-LEG DERRICKS erect roof and penthouse steel at east end of terminal. Erection of more than 9,000 tons of steel required for structure was completed in less than $3^1/_2$ months. Also, 2,100 tons of reinforcing steel were used in the 25,000 cu yd of concrete.

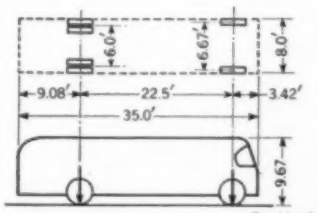
REINFORCED CONCRETE roof slab is poured in final stages of construction. Exterior walls of structure are buff-colored brick with white granite trim. Foundation walls were metallic waterproofed by Hudson Waterproofing Co.

the Bell System. Of this total, 22 are attended and 155 are coin-operated in booths spread throughout the terminal. All telephone booths, parcel lockers, and display spaces are recessed to provide smooth wall planes and unobstructed passage through the concourses.

Development of concession revenues, which will help meet the operating costs, was a consideration of major importance in the financing and design of the terminal. Within the framework of design dictated by the needs of handling buses on two levels and people on two concourses, the Port Authority integrated space for 48 efficiently located stores, services and a recreation center.

All commuter lines load on the suburban bus level, where 16 island-type platforms provide a total of 72 bus berths. These platforms are assigned to specific companies, so that a commuter taking the same bus daily always leaves the terminal from the same platform. The sixteen 12-ft-wide platforms are arranged in three major groups which are separated by diagonal interior roadways. The main roadways are at least 21 ft wide. The platforms are numbered for convenience to the commuter and are tapered to permit ease in bus parking. They are served from the suburban concourse below by 14 moving stairways and 16 stationary stairways.

FIG. 1. DESIGN LOADINGS for estimated maximum-size bus to use Terminal are based on impact in accordance with AASHO specifications.



			Total load
Dead load (Ready for road)	12.7	7.8	20.5
Live load	7.15	2.65	9.8
Total load (Loads are in kips)	19.85	10.45	30.3

Bus Movements Separated

For safety and efficiency, the incoming traffic is separated from the loading area by a 4-ft central island. This prevents any mixing of movements of the arriving and departing buses. As buses enter the terminal from the elevated ramp, a lighted sign divides all incoming buses, so that loaded buses move to the right and unoccupied buses to the left.

An interesting feature of the long-distance bus area on the lower level is a bus detecting system. By means of a control panel, dispatchers can tell the location of all buses at all times. Each bus flicks a light on when it passes over a treadle while pulling into its loading berth, and releases the light when it clears the treadle as it departs. The dispatcher directs incoming buses to berths as they enter by flashing numbers on a screen.

The Turner Construction Co., prime contractor for the terminal superstructure, started working at the site early in January 1950, and by November 1 had completed its contract for the building. In addition to the Turner Co., there were 6 prime contractors and 50 subcontractors. The other prime contractors were: W. M. Walsh Co., Inc., of North Bergen, N.J., borings; Howard Collins Construction Co., Inc., of New York, excavation; Foss, Halloran, Narr, Inc., of Long Island City, terminal foundation walls; Harris Structural Steel Co. of New York, terminal steel work and ramp steelwork; Gull Contracting Co., Inc., Flushing, N.Y., ramp foundations; Corbetta Construction Co. of New York, ramp superstructure.

LONGEST AND HEAVIEST girders on job are 129-ft, 45-ton steel members on West 40th Street entrance ramp.

OVERHEAD RAMPS connect terminal directly with Lincoln Tunnel Plazas, keeping buses out of city streets. Radiant heat keeps ramps free of ice in bad weather. Average grade is 3.5 deg and maximum is 7.5 deg.

Turkey expands her

İSMAIL İSMEN and VEDAT URUL,

Junior Members, ASCE

Respectively Research and Design Engineer and Soil Engineer, Bureau of Airports, Ministry of Public Works, Ankara, Turkey

IN TURKEY, a $16,000,000 program is under way to expand and modernize the country's air transport facilities. The design of the three major installations at Istanbul, Ankara, and Adana is based primarily on the recommendations of the International Civil Aviation Organization (ICAO) and specifications of the U.S. Civil Aeronautics Administration (CAA).

The Yesilköy International Airport is of the B1 long-range type (ICAO classification). Located about 11 miles southwest of Istanbul, it is Turkey's major civil airport. The present program calls for the construction of runways, taxiways, aprons, administration building, hangars, radio facilities, a drainage system, an electrical system, an instrument landing system, and simultaneous radio range station.

At present the NE-SW instrument runway has a length of 7,550 ft and a width of 200 ft. The taxiways are 75 ft wide. The pavement is designed for a single wheel load of 100,000 lb. Construction of the new N-S runway, 5,900 × 200 ft, is to be started in the near future.

Grading plans for this airport provide longitudinal slopes of not more than 1 percent and transverse slopes of not more than 2.5 percent over the entire landing strip. All the design factors are based on the latest CAA specifications.

Lighting equipment includes a beacon, high-intensity runway lights, taxiway lights, obstruction lights, apron floodlights, wind tee, and the necessary transformer vault and control equipment.

Soil conditions at Yesilköy are quite variable. The 3-ft-thick topsoil consists generally of a class E-8 soil (CAA designation). The subsoil varies but generally consists of class E-6 and E-7 soils. The E-6 soil is to be used as the subgrade material under the paved areas and is to be mixed in with some sand for the subbase material. The southwest end of the runway is underlain by clay, which will require some undercutting. The clay taken out will be used on the shoulders in very thin layers thoroughly mixed with some E-6 soil.

The pavement design provides for a base thickness of about 10 in. and a concrete runway pavement thickness of 12 in. The concrete surfacing of the taxiways, thickened runway sections and aprons will be 16 in. thick, over the same base. Concrete rather than bituminous pavements were chosen, mainly because jet planes are expected to use the airport.

The Esenboga Airport (ICAO class B1) is located about 19 miles northeast of Ankara. The present construction program is similar to that of Yesilköy, and the lighting equipment is the same.

The NE-SW instrument runway now under construction has a length of 9,000 ft and a width of 200 ft. The pavement is designed for a single wheel load of 100,000 lb. An E-W runway, 6,800 × 200 ft, is also proposed. On the Esenboga site, the soil is generally of class E-7 and the design was prepared accordingly, but subbase and pavement thickness are similar to those at Yesilköy Airport.

During the second Middle East Regional Air Navigation Meeting of the ICAO, held at Istanbul in October-November 1950, the Turkish delegation declared that the Esenboga Airport now under construction will be made available in the very near future for use as an alternate long-range airport and that it will continue to serve in that capacity until completion of a new runway in 1953, at which time it will replace the Ankara Civil Airport as the regular airdrome serving the city.

The improvements planned for Adana Airport involve paving a NE-SW runway, construction of a stub taxiway and control tower, and lighting facilities.

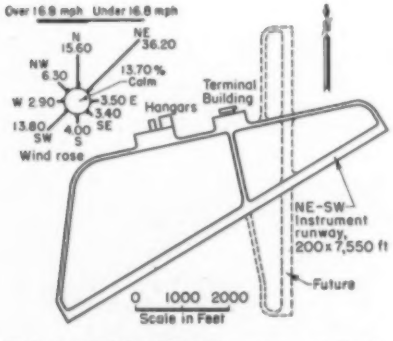


FIG. 2. PROPOSED N-S runway, at Yesilkoy Airport, will have over-all length of 5,900 ft and 200-ft width. Maximum longitudinal slope is 1 percent, while transverse slopes are 2.5 percent maximum.

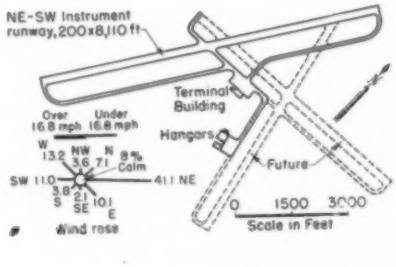


FIG. 3. EXPANSION of Esenboga Airport, at Ankara, includes two proposed runways, NE-SW, to be about 9,000 ft long, and E-W, to be 6,800 ft long. Pavements are designed for single wheel loading of 100,000 lb.

air transport facilities

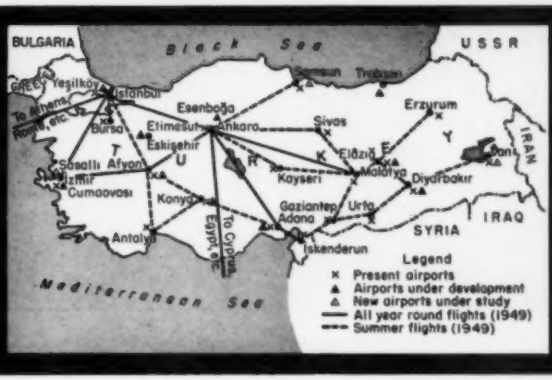


FIG. 1. BULK of $16,000,000 Turkish air transport program involves Istanbul, Ankara, and Adana. Lighting and traffic control facilities will be provided at İzmir, Afyon, and Diyarbakır, while control towers are to be constructed at Elâsığ, Konya and Erzurum. Scraper (far left) is part of heavy equipment used to move 655,000 cu yd of earth at Ankara's Esenboğa Airport.

The length of the proposed runway is 6,490 ft, which is the basic length of an ICAO class C2 runway corrected for density altitude at Adana.

The principal grading to be performed at this airport is along the sides of the runway and taxiway to slope the landing strip up to the edge of the pavement. The soil is of classes E-3 to E-7. The pavement design provides for a sand and gravel subbase and concrete pavement. The lighting facilities planned include a beacon, taxiway lights, obstruction lights, apron lights and a lighted wind tee.

Terminal Buildings Identical

Two identical terminal buildings, one for Yesilköy Airport, and the other for Esenboga Airport, were designed by the Luria Engineering Corporation. The basic unit of each terminal is a 90×358-ft three-story structure surmounted by a two-story tower. Total floor area is 74,000 sq ft, of which 22,000 sq ft is occupied by offices. A complete array of the most advanced communications equipment will be housed in the base of the tower atop the terminals. The tower will also incorporate the latest in airport traffic control devices.

Heating is provided by a low-pressure steam system with an oil-fired automatic boiler. The lighting system is generally built-in fluorescent, supplemented by incandescent equipment.

Prefabricated Hangars Provided

Maintenance and storage accommodations for the largest transport planes now in use, including DC-6's, Constellations and Stratocruisers will be provided by two prefabricated Luria-type hangars, one for the Yesilköy Airport, and the other for the Esenboga Airport. Each hangar is 240 ft long, has a gabled roof, and is built entirely of steel. There are clear openings 160 ft wide by 30 ft high at both ends of the hangar, each provided with eight doors that roll sidewise. At both ends, lift doors permit the passage of the airplane tail.

Both sides of the hangar are provided with a leanto 38 ft wide by 24 ft high extending the full length of the hangar. These units will house maintenance and repair shops, offices, and heating and power installations.

The main structural elements are 13 three-hinged arches tied under the floor. Roofing and door covering consist of insulated corrugated steel, and the walls are of masonry. All structural connections are bolted. The hangar is designed for a roof load of 30 psf and a wind load of 20 psf.

A loan of $3,400,000 was granted by the Export-Import Bank of Washington, D.C., and in July 1947, the Turkish Ministry of Communications entered into a contract with the Westinghouse Electric International Co. for furnishing materials required for the construction, and with The J. G. White Engineering Corporation for designing the airports and providing engineering supervision of the construction work. In May 1949 the responsibility for construction was transferred from the Turkish State Airlines of the Ministry of Communications to the Bureau of Airports of the Ministry of Public Works. The contract with The J. G. White Engineering Corp. expired on January 11, 1950, and the Bureau of Airports is completing the program with the aid of some American advisers.

YESILKOY INTERNATIONAL AIRPORT at Istanbul is designed to meet latest ICAO standards and specifications of United States CAA. Present NE-SW instrument runway has length of 7,550 ft, and pavement is designed for single wheel load of 100,000 lb.

Warped-surface layout method aids dam construction

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U.S. Bureau of Reclamation, Denver, Colo.

FIG. 1. MANY changes in slope required warped surface for Cle Elum earthfill dam on Yakima Project, Washington.

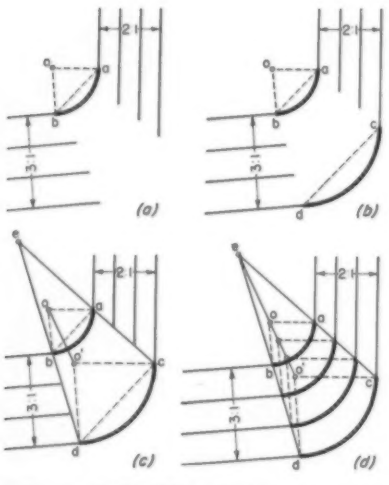

FIG. 2. DIAGRAMS illustrate steps by which curves for intermediate or warped contours are fixed. (*a*) Radius and curve are selected for one edge of warped surface. (*b*) Length of curve or chord desired at opposite edge is chosen. (*c*) Radii are computed and lines drawn connecting centers of two curves and points of tangency of both curves. (*d*) Perpendiculars erected at intermittent points of tangency intersect line of centers and fix curves for intermediate contours.

IN THE CONSTRUCTION of dams, particularly earth dams, it is often necessary to warp the upstream or downstream slopes into the abutment slopes. Typical of such construction is the Cle Elum Dam on the Bureau of Reclamation's Yakima Project in Washington. A general plan of the dam, Fig. 1, illustrates the many changes in slope which required warped surfaces for this structure.

Staking out of such warped surfaces presents many problems for the construction engineer when the surfaces are not clearly defined on the drawings. Frequently designers draw these transition surfaces with irregular curves and leave the layout in the field to the imagination and discretion of the construction forces. To avoid this practice, the writer has developed a definite geometric method for constructing a warped surface so that coordinates can be established, and radii, length of curves, and angles given to facilitate the staking of slopes.

The method is illustrated in Fig. 2. A radius and curve are selected for an edge of the warped surface, either on the bottom or top of the slope, in such manner that the curve is tangent to the contours of both surfaces, Fig. 2(*a*). The length of curve or chord desired at the opposite edge (top or bottom) is also chosen, Fig. 2(*b*). The radius required for the curve of the latter edge is computed from the relation that the radii and chords are proportional. Lines are drawn connecting the centers of the two curves and connecting corresponding points of tangency, Fig. 2(*c*). These lines are the loci of the centers and points of tangency, respectively.

Perpendiculars are then erected at intermittent points of tangency which are located by the intersection of contours with the line connecting the corresponding tangent points. These perpendiculars intersect the line of centers and fix the centers and radii of corresponding curves for intermediate contours, Fig. 2(*d*).

The advantages of this geometric method are:

1. Deflection angles can be used to construct the warped surface since only simple circular curves are involved.

2. If the lines connecting the tangent points converge within a reasonable distance, a transit set up at the point of intersection, as illustrated in Fig. 3, can be used to direct the placing of slope stakes for the surface along the line of sight, which has a constant slope along any radial line over the warped surface.

3. Slope boards can also be installed along the radial lines near the toe of the surface for sighting in the uniform slope with the aid of a measuring rod while construction proceeds unhampered.

4. A warped surface with a uniform transition is obtained.

5. The design office can specify the exact shape and location of the surface, thus expediting the work in the field.

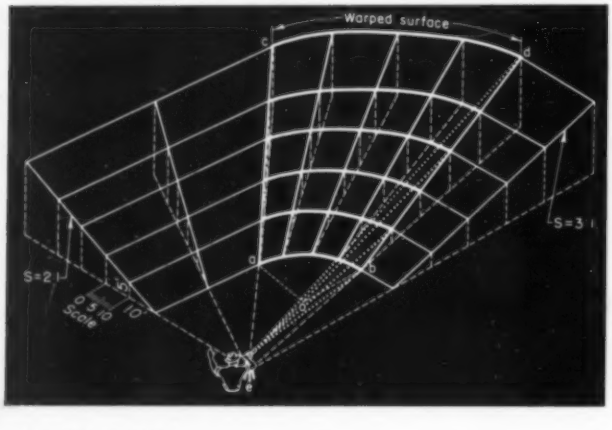

FIG. 3. TRANSIT can be set up at point of intersection of horizontal projection of lines connecting tangent points if these lines converge within a reasonable distance. Transit can then be used to direct placing of slope stakes for surface along line of sight, which has constant slope along any radial line over the warped surface.

ENGINEERS' NOTEBOOK

Loading machine provides for adjustment of photoelastic specimens

WILLIAM B. STILES and ARDIS WHITE, Jun. M. ASCE

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A CONVENIENT, inexpensive apparatus for loading and holding photoelastic specimens was designed and built in connection with a course in experimental stress analysis at the University of Arkansas. The apparatus, shown in the accompanying photograph, makes it possible to translate the specimen horizontally and vertically and also to rotate it about horizontal and vertical axes which are perpendicular to the axis of the polariscope. These adjustments are desirable in obtaining accurate photographic records showing boundary conditions. The elements of the polariscope (removed before the photograph was taken) are mounted on a fixed triangular optical bench, part of which may be seen in the foreground.

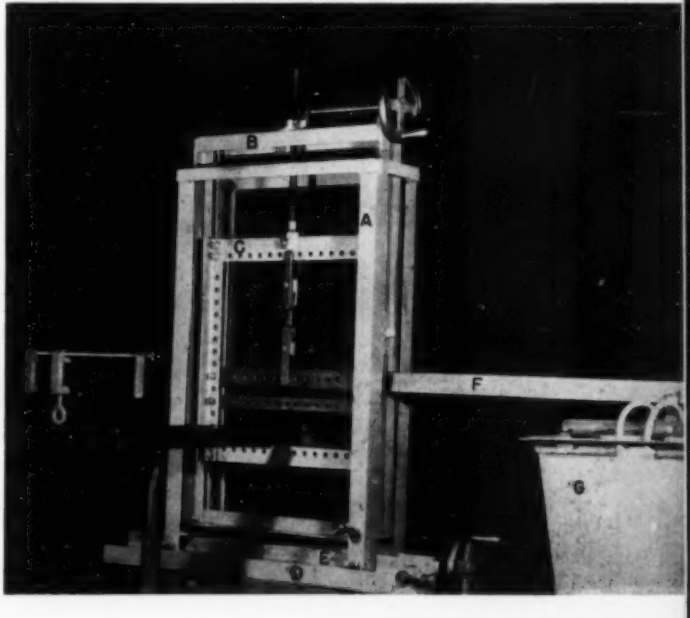
The base of the loading apparatus is in two parts. The lower part *D* is bolted rigidly to the table, and the inner movable base *E* rotates about a vertical pivot at the center of the fixed base. This horizontal rotation is adjusted by means of two screws at the right end of the fixed base *D*, one of which is visible in the photograph.

The upright frame consists of three parts. The outer frame *A* is mounted on horizontal slides on the rotating base *E* and can be moved horizontally by the handwheel at the right end of the base. The middle frame *B* is pivoted to the outer frame about a horizontal axis near the center. The rotation of the middle frame about the horizontal axis is controlled by a second set of adjusting screws at the bottom of the outer frame.

The inner frame *C* slides vertically in the middle frame and is held upright by the top and bottom members, which extend through slots in the sides of the middle frame. The vertical position of the inner frame is controlled by a vertical, threaded rod and the handwheel and bevel gears at the top of the middle frame. Thus the specimen has four degrees of freedom of motion, which can be adjusted by the two handwheels and the two sets of adjusting screws. The specimen can be moved 10 in. horizontally and $9^1/_2$ in. vertically. The rotational adjustments amount to ± 5 deg about each axis.

Load on the specimen is provided by filling the tank, *G*, at the right end of the loading arm *F* with water. The loading arm is pivoted at the left side in the inner frame and is supplied with a counterweight at its left end to balance the empty tank. The specimen in the photograph is being loaded in tension. For a compression test, the specimen is placed between the loading arm and the bottom of the inner frame, or the adjustable member just below the loading arm in the picture. Flexural models are also placed between the loading arm and the adjustable member.

Calibration of the testing machine was accomplished by means of a thin steel tensile specimen with an SR-4 electric strain gage on each side. The tensile specimen was first calibrated by means of dead weights. The water tank at the end of the loading arm is a double tank having a small inner tank for small loads and a larger outer tank for larger loads. A pair of piezometers on the side of the tank indicate the water level in the two tanks, and consequently the load on the specimen. When the specimen is placed at the middle of the inner frame, the maximum load is approximately 800 lb.



LOADING MACHINE for photoelastic specimens permits adjustment of position of specimen to obtain accurate photographs of boundary conditions. Loading in either compression or tension is provided by water-filled tank *G*, at right.

Base plates for fixed-end columns should be designed to resist uplift

STEPHEN W. WATERMAN, Jun. M. ASCE
Designer, Foster-Wheeler Corp., New York, N.Y.

MOMENT CONNECTIONS of steel columns to their foundations, where the moment is sufficient to produce uplift on the base plate, have been treated rather lightly in the more popular texts used as guides by designers. One of the usual design procedures has been to assume that the anchor bolts must provide initial tension sufficient to prevent uplift on the base plate. Another method is based on the combined direct-load and flexure formula,

$$f = \frac{P}{A} \pm \frac{Mc}{I}$$

Where Mc/I is greater than P/A, it assumes that the anchor bolts, acting as a couple, will resist the moment, and that the concrete stress will be $(P/A) + (Mc/I)$.

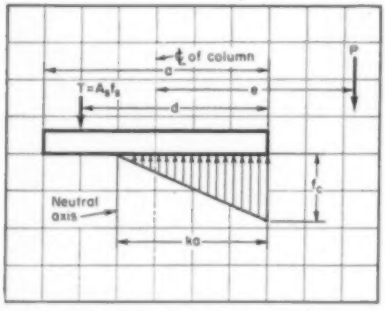


FIG. 1. BASE PLATE for fixed-end column is to be designed to resist uplift.

Both these methods are inexact, the former because it assumes a completely indeterminate quantity, and the latter because it disregards the fact the I/c is a variable when Mc/I is greater than P/A, and that the location of the anchor bolts is important in determining the stresses they will develop.

The method to be developed here is based on the premise that uplift exists on the base plate and is resisted by the anchor bolts as "active" tension, taking into account the effects of anchor-bolt location and varying section modulus. The problem is stated in Fig. 1, in which

a = length of base plate
b = width of base plate
A_s = net area bolts (one side)
P = column load
M = column moment
e = M/P = eccentricity of load
f_c = concrete unit stress
f_s = bolt unit stress
d = distance from bolt to edge of plate
n = E_s/E_c

From the diagram, the unit stress in the anchor bolts can be expressed as a function of the unit stress in the concrete:

$$f_s = nf_c\left(\frac{d - ka}{ka}\right) = nf_c\left(\frac{d}{ka} - 1\right) \quad . . .(1)$$

By the summation of the forces acting on the plane, we get,

$$P = {}^1/_2 f_c kab - f_s A_s$$

$$P = {}^1/_2 f_c kab - nA_s f_c\left(\frac{d - ka}{ka}\right) \quad . . .(2)$$

Solving for f_c,

$$f_c = \frac{2kaP}{bk^2a^2 - 2nA_s(d - ka)} \quad . . . . . (3)$$

By the summation of the moments about the center line of the column acting on the plane, we get,

$$Pe = \frac{1}{2} f_c kab\left(\frac{a}{2} - \frac{ka}{3}\right) + nA_s f_c\left(\frac{d - ka}{ka}\right)\left(d - \frac{a}{2}\right) \quad . .(4)$$

Solving for f_c,

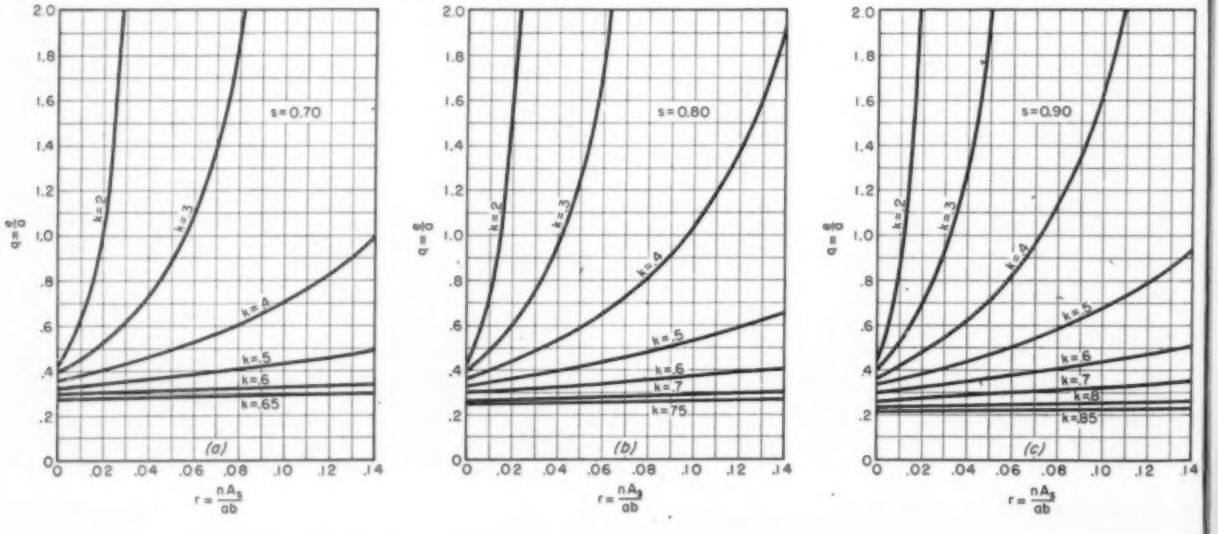
$$f_c = \frac{12kaPe}{k^3a^3b(3a - 2ka) + 12nA_s\left(d^3 - kad - \frac{ad}{2} + \frac{ka^2}{2}\right)} \quad . . . .(5)$$

Equating the two expressions for f_c results in the following cubic equation,

$$k^3(2a^3b) + k^2(6ea^2b - 3a^3b) + k\left[12nA_s ea - 12nA_s a\left(\frac{a}{2} - d\right)\right] = 12nA_s ed + 12nA_s\left(d^2 - \frac{ad}{2}\right) \quad .(6)$$

Since Eq. 6 is rather cumbersome, it will be further simplified. However, it is well to note at this time that the minimum values of a, b, and d are limited by the size of the column. Thus, the only real assumption will be a value of A_s. A solution of the

FIG. 2. CURVES for three values of s (which equals d/a) give values for k, which can be substituted in Eq. 6 to obtain values of f_c and f_s. In (a), $s = 0.70$; in (b), $s = 0.80$; and in (c), $s = 0.90$.



cubic equation for k, can usually be made in three or four trial substitutions of values of k.

A further simplification of the basic Eq. 6 is obtained by dividing through by a^3b:

$$2k^3 + (6q - 3)k^2 + (12rs + 12qr - 6r)k = 12qrs + 12rs^2 - 6rs \quad . \quad (7)$$

where $q = e/a$, $r = nA_s/ab$, and $s = d/a$.

The three charts, (*a*), (*b*) and (*c*) of Fig. 2, have been prepared for values of $s = 0.70$, 0.80 and 0.90, which is the usual range of locations for anchor bolts. Values of k can be obtained directly using the known values of q and r. Substitution of the value k in the equations for f_c and f_s will yield the concrete and anchor-bolt unit stresses. If the unit stresses found exceed the allowables, the values of a, b, and A_s can be revised until satisfactory unit stresses are obtained.

THE READERS WRITE

Reinforced Concrete Versus Cellular Wharf Construction

TO THE EDITOR: Lately I have noticed numerous articles in the various engineering publications relative to the adoption of the typical steel sheetpile cellular cofferdam construction to the use of ship-berth, wharf or pier construction. Almost without exception these articles refer to this use of cellular construction as an innovation in pier construction and would lead a reader to believe that its use is far less costly than the standard construction of reinforced concrete or framed steel.

In 1930 the predecessor to the Ewin Engineering Corporation, Doullut & Ewin, used a modified form of cellular construction for a pier at Panama City, Fla. Again during World War II, this same corporation adopted the truly cellular construction to its design for a pier at the Alabama Dry Dock & Shipbuilding Co. in Mobile, Ala., alongside of which a large floating dry dock was moored.

Again, in 1946, when the present Ewin Engineering Corporation was engaged by the Alabama State Docks and Terminals to make an engineering plan for future expansion of their ship berthing facilities at Mobile, Ala., among the several types of design considered for the several marginal wharves of the new berths, was the cellular steel sheetpile construction. This type was not adopted for the final design as it was found to be more expensive than an all-concrete wharf supported on reinforced concrete piling and supplied with a light steel sheetpile cutoff wall along the inshore edge.

Thus for many years we have considered the steel sheetpile cellular type of construction for our pier and wharf designs. However, unless there is some special load, or other requirement which would dictate this type of construction instead of the concrete-pile-supported, flat-slab deck wharf, we have never been able to justify its higher cost.

TRUMAN A. SMITH, M. ASCE
President, Ewin Engineering Corporation
Mobile, Ala.

EDITOR'S NOTE: One of the earliest uses of the cellular steel sheetpile cofferdam was in 1911 for raising the USS *Maine*, which had been sunk in 35 ft of water in Havana Harbor in 1898. Around the wreck, interlocking piles were driven to form 22 cylindrical cells, which were connected with fillets. Twelve of the cells were 50 ft in diameter, the other ten, 40 ft.

Constant-Angle Arch Dam Compared with Other Types

TO THE EDITOR: In his letter in the February issue, "Economy of Constant-Angle Arch Dam Depends on Site Conditions," Horace A. Johnson states that the type of dam selected is dependent on site conditions, the truth of which is evident. It is also evident that the constant-angle arch type requires unyielding abutments, sufficiently close together in relation to the height of the dam, as otherwise arch action cannot be economically secured.

The statement that in some cases an arch dam would require more concrete than a gravity dam is not applicable because if arch action cannot be economically obtained, the structure automatically becomes a gravity dam. However, many gravity dams have been designed in the arched shape, which has the advantage of increased safety, not because of arch action but because the pressure on the foundation is more favorably distributed.

At a given site the cost per acre-foot of storage does not enter into the comparison because if this cost is high for an arch dam, it will be still higher for a gravity dam.

As for the comparative costs of concrete gravity and arch dams, extensive studies for the Ross Dam, in Washington, by the late Lars Jorgensen, M. ASCE (*Engineering News-Record*, October 14, 1937) showed that, for the same expenditure, the 3:1 ratio of storage in favor of the arch held for a considerable range of dam heights. For this site Jorgensen stated that the saving to be credited to the arch type was about $5,000,000. This dam, one of the world's tallest, was not listed in my table (November 1950, p. 45).

The economy of the constant-angle dam as compared with the constant-radius arch dam was studied and reported on in 1929 by G. E. Goodall, M. ASCE, at that time designing engineer in Jorgensen's office. Mr. Goodall investigated three constant-angle arch dams built by the Salt River Valley Water Users' Association: Mormon Flat (22), Horse Mesa (27), and Stewart Mountain (42) (the numbers refer to my table) and found that the constant-radius type would have required respectively 42, 32 and 15 percent greater yardages of concrete. These savings were for the arches only, the abutments and spillways being assumed as the same for both types.

The fact that no arch dam has ever failed indicates the great reserve strength in such structures as compared to the gravity type, of which 69 have failed to date, mostly by sliding. This fact is the more impressive considering that there are almost one-third more arch dams in existence than gravity dams of comparable height (see R. A. Sutherland, M. ASCE, *Engineering News-Record*, Dec. 10, 1936, p. 815).

J. J. POLIVKA, M. ASCE, *Consultant, Constant-Angle Arch Dam Co. Lecturer, Stanford University*
Berkeley, Calif.

SOCIETY NEWS . . .

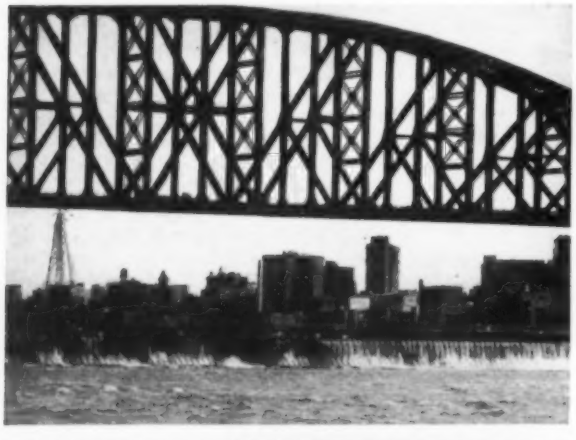
Extensive Technical Program to Feature Louisville Convention

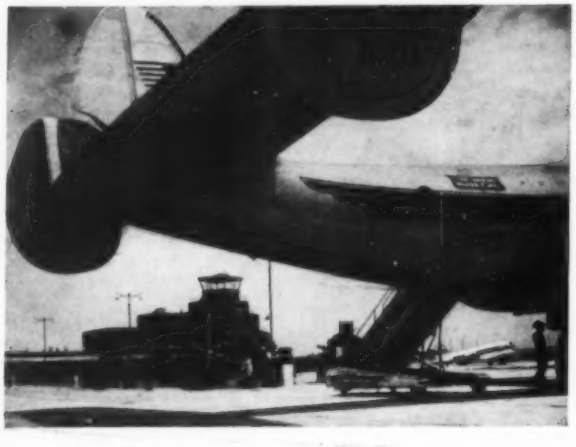
A full program of technical papers, outstanding speakers, and social events is planned by the Kentucky Section for the enjoyment of engineers and their families attending the Louisville Convention of ASCE, June 13–15. Nearly all the Society's 14 Technical Divisions are arranging meetings, which will include an exceptional joint session of the Construction and Structural Divisions on bridge design and construction. Many of the papers will be printed in the July issue of CIVIL ENGINEERING. Samuel M. Bailey is chairman of the technical program.

To permit scheduling of an unusually extensive program, innovations have been made in plans for entertainment, which will include a smoker for engineers on June 13, sponsored by the District 9 Council, and a dinner-dance on June 14. Numerous tours have been planned to points of interest in the Louisville area, including Ohio River flood control and navigation works and Churchill Downs, scene of the famous Kentucky Derby, in the picturesque "blue grass" country. In addition to the Ohio River projects, engineers will find much of interest in the Louisville area—Memorial Bridge, the highest continuous steel deck bridge in the United States, spanning the Kentucky River at Clay's Ferry, Ky.; the Pennsylvania Railroad Bridge connecting the city with Jeffersonville, Ind.; the new $3,000,000 Sandiford Field Airport, said by authorities to be "one of the best in the United States"; and many other projects.

The ladies of the Kentucky Section, under the chairmanship of Mrs. Samuel M. Bailey, are arranging an interesting program for the distaff visitors. Teas and tours will be featured, with a new event, an evening sociable, to be held coincident with the men's smoker. Through special arrangement, visits to beautiful private gardens will be possible. To take full advantage of the various events planned, visiting ladies are advised to bring comfortable walking shoes, light sports clothing, and an evening wrap.

The complete program of Technical Division meetings and the other events of Convention week will be printed in the May issue. Charles W. Lovell, general chairman of arrangements, urges that early plans be made for attendance at the Convention which promises a delightful week of Southern hospitality in a region noted for its scenic charm and historical associations. Headquarters for the Convention will be the Brown Hotel in downtown Louisville, convenient to all transportation facilities.





LOUISVILLE SKYLINE is seen against background of famous falls of the Ohio River in upper view. The Pennsylvania Railroad Bridge, in foreground, connects the city with Jeffersonville, Ind. Lower photo shows Administration Building at new Sandiford Field Airport, recently completed at cost of $3,000,000 by City of Louisville and Jefferson County Air Board. Photos courtesy of Chamber of Commerce.

Pacific Northwest Engineers Schedule Annual Conference

Plans for the third annual meeting of the Pacific Northwest Conference of ASCE, to be held at the Multnomah Hotel in Portland, Oreg., April 27 and 28, are announced. The Oregon Section will be host to the meeting, which is being arranged under the direction of Section President Guy H. Taylor, who is vice-chairman of the conference. Conference chairman is Thomas H. Campbell, of Seattle and R. O. Sylvester, also of Seattle, is secretary-treasurer.

The two-day program, tentatively includes an address by Jesse E. Buchanan, M. ASCE, president of the University of Idaho; a group of papers on "Water Resources and Problems in the Pacific Northwest," to be followed by an open-forum discussion; and an address by ASCE President Gail A. Hathaway. A Local Section Forum will follow Mr. Hathaway's talk, to be given at a dinner meeting on Friday evening, April 27. An all-day trip to Detroit Dam on Saturday will be preceded by a breakfast, at which engineer and contractor personnel will give briefing talks on the project. Members of the Conference Board of Directors and their wives will be guests of the Oregon Section at an informal dinner on Thursday evening, and there will be a dinner dance on Saturday evening.

Participants in the Pacific Northwest Conference are the Montana, Southern Idaho, Columbia, Spokane, Oregon, Tacoma, and Seattle Sections.

Carlton Proctor Is Nominated for ASCE President in 1952

Carlton S. Proctor, New York City consultant with a long record of professional and civic achievement, was nominated for 1952 President of the Society by the ASCE Board of Direction at its Houston meeting. A member of the Society since 1925, Mr. Proctor has served it with distinction in several important posts. He was Director for District 1 from 1936 to 1938, and Vice-President for Zone I in 1948 and 1949, serving on the Executive Committee of the Board of Direction during part of his tenure in both offices. Other Society committees on which he has served include the Securities Committee (1936 to 1940) and the Committee on Private Engineering Practice (1944 to 1946). Active in the organization of the Soil Mechanics and Foundations Division, he was chairman of the Division from its inception in 1936 until 1942, when he resigned to enter the Army.

Following his graduation from Princeton University in 1915 with the degree of civil engineer, Mr. Proctor became superintendent of construction for the Washington branch office of McKenzie, Voorhees & Gmelin, New York City architects. In 1919, after wartime service in the Construction Division of the Army, he joined Daniel E. Moran, M. ASCE, in forming the consulting firm of Moran & Proctor, now Moran, Proctor, Freeman & Mueser.

Mr. Proctor's firm, which specializes in substructure engineering, has served as consultant on design and construction of the foundations for such important projects as the Philadelphia-Camden Bridge, the Ambassador Bridge at Detroit, the Mid-Hudson Bridge, and the San Francisco-Oakland Bay Bridge. It has also acted as consultant on dam, powerhouse, and tunnel structures throughout the United States and abroad, and on the foundations for a number of New York buildings and skyscrapers. Its foreign projects have included the Svir-Stroy Dam and Navigation Docks and Canal in Russia, the foundations for the Palace of the Soviets in Moscow, and about twenty engineering projects in Brazil.

During World War II, Mr. Proctor had the rank of colonel in the Engineer Corps, serving as commanding officer of the 334th Engineer Regiment (S.S.) and of the Desert District, Persian Gulf Command. He was decorated with the Legion of Merit and retired for line-of-duty disability.

Mr. Proctor's professional and civic services include the chairmanship of the Engineers Code Committee and three years as ASCE appointee to the Engineers National Defense Board. In 1944 and 1945 he was a member of the National Engineers Committee on the Industrial Disarmament of Germany, which made a study and prepared a report for the

CARLTON S. PROCTOR
Nominee for President of the Society

U. S. Departments of State and War. A year later he served as chairman of a similar committee that reported to the State, War, and Navy Departments on the industrial disarmament of Japan. For his work on the two disarmament reports, he received the President's Certificate of Merit.

ASCE representative on Engineers Joint Council since its inception, Mr. Proctor is currently chairman of its National Engineers Committee and of its Committee on National Defense. He is also a member of the Committee on Constitution and By-Laws and the Commission on Latin America. He is also an alternate on the EJC Council.

Mr. Proctor has also been a member of the U. S. Industrial Advisory Board, the New York City Construction Code Committee, the council of the American Institute of Consulting Engineers; director, vice-president, and president of the Society of the Moles; and director of the New York Building Congress. At present he is vice-chairman of the Chamber of Commerce Committee on Construction Mobilization. He has also been active in the alumni affairs of Princeton University, which in 1947 awarded him the honorary degree of doctor of engineering, citing him for his services as Engineer Officer in both World Wars and as an "outstanding authority on foundations, and engineer on some of the world's largest bridges."

New J. Waldo Smith Fellowship Announced

Availability of a new J. Waldo Smith Hydraulic Fellowship to graduate students interested in the advanced study of hydraulics is announced by the award committee. A comprehensive investigation of a timely subject in the field of hydraulics or hydraulic engineering is proposed by the committee, which states that the project should be geared to completion within a year with the production of some interesting and useful information. Applications must be in the hands of the chairman, Clarence E. Bardsley, 4516 Harling Lane, Bethesda 14, Maryland, by May 15, and announcement of the award will be made shortly thereafter.

As in the past, the fellowship will be of joint interest to both the graduate student and the institution through which he will work, and the applications should be routed through the institutions themselves. The fellowship currently carries a stipend of $1,000, plus an allowance for equipment up to $400.

Conditions of administering the fellowship are given in the Society's 1950 Official Register.

District 10 Conference to Be Held in Charlotte

Plans for a forthcoming District 10 Conference of Local Sections, to be held in Charlotte, N.C., April 20 and 21, are announced by Conference Chairman Edward B. Rice. Numerous aspects of Section operation and Society-Section relationships will be explored in the two-day program, which will also include talks by ASCE officers attending. A social hour and buffet dinner at the Charlotte City Club on the evening of the 20th will bring the group together with members of the North Carolina Section.

Col. J. N. Pease is vice-chairman of the District 10 Conference, and J. F. Pou, secretary-treasurer. A block of rooms has been reserved at the Hotel Barringer in Charlotte for those planning to attend. A report on the number of delegates and requests for hotel accommodations should be addressed to Colonel Pease, Box 1902, Charlotte, N.C.

GROUP OF ASCE MEMBERS are honor guests of Association of Professional Civil Engineers of Mexico at luncheon celebrating its fifth anniversary. Two members of ASCE contingent are shown at the head of table with presiding officer Alberto J. Flores, dean of engineering at University of Mexico (center). They are Prof. John A. Focht (far left) and Roy G. Cappel (far right).

Mexican Engineers Are Host to ASCE Group at University of Mexico Ceremonies

International relations between the United States and Mexico were further strengthened by the generosity of Mexican engineers in inviting a group of ASCE members at the Houston Meeting to attend recent ground-breaking ceremonies for a new Engineering School at the University of Mexico. Making the trip, which was provided by the Mexico Section, were Prof. John A. Focht, of the University of Texas (substituting for Texas Section President R. F. Dawson); James D. Tidwell, of Texas A & M College, winner of the South Central Regional Student Contest for the best paper, awarded at the Houston Meeting; H. P. McAlister, of Rice Institute, chairman of the Texas Student Conference; and Roy G. Cappel, Jun. M. ASCE, of New Orleans, La., winner of the 1950 Mead Prize, which was presented at the Houston Meeting.

An entire day was devoted to the ceremonies initiating a new building program for the University of Mexico, which included addresses by Miguel Aleman, president of Mexico, and other government officials. After the cornerstone had been poured for the new Engineering School, a group of about 3,000 was entertained at a luncheon in the university law building, which at that stage of construction consisted of three concrete floors supported on concrete columns without walls, affording a pleasant meal in the open with a view of the entire campus. Located on a 1,900-acre site in University Center, the new Engineering School will be one of numerous impressive structures to be erected in the university's building program. Contracts totaling $10,000,000 have already been awarded for its construction.

Under arrangements made by A. M. Valdes, president of the Mexico Section, and F. J. Serrano, the ASCE group had an opportunity to tour other buildings going up on the university campus as well as many interesting new construction projects in the city—among them a 40-story riveted steel-frame building, which will have partially floating and partially supported foundations. The ASCE group were also guests of honor at a luncheon of the Association of Professional Civil Engineers of Mexico, which was celebrating its fifth anniversary, and at numerous other entertainments including a dinner and buffet supper given by Mr. Valdes. Two days of relaxation and sports at Acapulco completed the trip, which was voted by all a "material contribution to good relations between the two countries."

Engineers Joint Council Launches National Programs

Principal actions of Engineers Joint Council, which met in New York on March 16 with EJC President James M. Todd, of ASME, in the chair, are briefed here.

Havana Conference on UPADI

Council voted to urge each of its constituent societies to send its secretary to the Havana Conference on Pan-American Union of Engineering Societies (UPADI), to be held April 19–22, 1951. The purpose of the Havana Conference, which follows by one day a meeting of the Cuban Engineering Society, is to take further steps toward the formation of a permanent organization to unify the engineering societies of the Western Hemisphere.

National Water Policy Panel

The EJC National Water Policy Panel has analyzed the three-volume report of the President's Water Resources Policy Commission and reported to Council that "while certain recommendations of the President's Commission are acceptable, nevertheless the underlying philosophy of this report is so radically different from that expressed in our June 1950 statement, that the two documents are completely incompatible." Chairman W. W. Horner, of the Panel, presented the Panel's recommendation that EJC transmit to each member of Congress a brief review of the philosophic background of the report of the President's Commission and an equally brief statement showing that in many respects the recommendations of that report violate the fundamental principles of the Panel's statement, both to be accompanied by a printed, reedited copy of the EJC statement of desirable water policy. Council approved these proposals.

Engineering Manpower Commission

Plans of EJC's Engineering Manpower Commission to launch a $100,000 campaign to inform the public of the importance of the engineering profession and to insure adequate supply and optimum utilization of engineers in industry, in construction, and in the Armed Forces have been initiated. ASME Secretary C. E. Davies has been named director of the program (without pay), and funds are being solicited from all employers of engineers in business, industry, and public or private construction to finance the program. Essential information regarding the shortage of engineers is being mailed to 23,400 principals of high schools and junior high schools, and to 25,000 teachers of mathematics and 28,000 teachers of science in high schools. Director C. E. Davies has testified on behalf of EJC before the Senate Armed Services Committee which is considering Bill S-1. He urged inclusion of provisions to permit college students to continue their education before being called to military service; to avoid induction of engineering manpower into the armed services for nontechnical assignments; to utilize engineering manpower now in industry to the best advantage; and to authorize appointment by the President of an essentially civilian committee to advise him and government agencies on engineering and scientific manpower problems.

The Engineering Manpower Commission announced at its meeting late in March that Carey H. Brown, M. ASCE, has been selected as its chairman, and that T. A. Marshall, Jr., has been appointed its executive secretary.

Increased Benefits Available to Insured Members

A recent letter from Smith and Sternau, Inc., administrators for the group insurance disability plan adopted by the Board of Direction about two years ago, calls to the attention of the Executive Secretary extended benefits to become available to policyholders without additional costs as of August 1, 1951. At the request of the Board at its Houston Meeting, essential excerpts from the letter are printed here.

". . . . These broader benefits will naturally be available to all members who are now participating in the plan, as well as members who enroll in the future. The extended benefits will be as follows:

"1. *Disability Due to Illness:* The weekly indemnity will now be payable for two full years, rather than one year.

"2. *Partial Disability:* Partial disability arising from injuries will be increased from four to six weeks.

"3. *Elective Benefits:* This provides that in the event of the more serious injuries, the insured may elect to receive a lump sum in accordance with a schedule, if he so desires, in lieu of weekly indemnity. For example, if a member breaks an arm, he may elect a single sum, regardless of whether or not he returns to work before the weekly indemnity would equal the stipulated compensation. The result, is most instances, means more adequate compensation for such injuries.

"These extended benefits which we have been able to secure for your members are in addition to all other basic benefits under the original plan. They were made possible because of the enthusiastic reception of the plan by your members, which has meant favorable experience. We feel certain that as more members join the plan, we will be able to secure other attractive extensions.

"The necessary endorsements to those members now insured and a notice to all other members will be sent out during the first part of July. . . ."

New Binders Aid Filing of "Proceedings" Separates

For the convenience of members wishing to file pamphlet copies of the new Proceedings Separates, the Society is making available a handy binder in stiff black covers of simulated leather material. A rounded backbone is fitted on the interior with slots, top and bottom, to permit insertion of each Separate, which is then held by its own wire attachment. The pamphlets can easily be removed or replaced, giving flexibility to the filing system and solving the problem of assembling the Separates in some combined form.

The binders are large enough to hold 30 Separates, so that two of them will probably accommodate the full number most members will need at any one time. The construction is such that the binders will stand upright, whether full or empty. In this position they are identified by the Society seal and the words, "Proceedings Separates" in gold lettering.

The binders may be ordered from Society Headquarters, 33 West 39th Street, New York 18, N. Y., at $2 each, net, prepaid within the United States.

Banquet Honors Retiring Vice-President Sherman

Henry J. Sherman, who retired in January as ASCE Vice-President from Zone II, was honored at a banquet held at the Engineers' Club in Philadelphia on March 16. ASCE Director Francis S. Friel was

Henry J. Sherman

master of ceremonies in a program of tributes to Mr. Sherman by ASCE President Gail A. Hathaway, Past-Presidents R. E. Dougherty and Franklin Thomas, and Charles E. Smith, veteran Society member of New Haven. Among others present to honor Mr. Sherman were ASCE Past-President Ernest E. Howard, Assistant Secretary E. L. Chandler, Don P. Reynolds, assistant to the Secretary, and 40 members of the Philadelphia Section.

In accepting a Certificate of Service from Mr. Howard, Mr. Sherman stressed the privilege of serving on the Board of Direction and "the high quality of the contributions of Board members."

District of Columbia Engineers Conduct Forum on Registration

COMPLETION OF NATION-WIDE professional registration is celebrated by well-attended forum discussion of recent Registration Act providing registration for District of Columbia, under sponsorship of D.C. Council of Engineering and Architectural Societies and Washington Engineers' Club. Forum leaders and speakers of evening are (left to right) Congressman Carl Hinshaw, M. ASCE, sponsor of the registration bill; Col. W. L. Simpson, M. ASCE, chairman of Council's Registration Committee; Daniel Walser, M. ASCE, civil engineer member and chairman of D.C. Registration Board; Dean S. S. Steinberg, M. ASCE, chairman of Maryland Registration Board; Clifford A. Betts, M. ASCE, chairman of Council; P. H. McGauhey, M. ASCE, chairman of Virginia Registration Board; Frank Hanrahan, M. ASCE, forum leader; Leo H. Cleary, secretary of D.C. Board of Registration for Professional Engineers; M. T. Bennett, chemical engineer member of Board; and L. J. Purnell, unclassified engineer member of Board. M. X. Wilberding, mechanical engineer on Board, was absent. Audience of 700 took part in the forum, which was held in Washington on February 23.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Legislation

The Renegotiation Act of 1951 (P.L. No. 9) was finally passed by both Houses after the Senate made many changes in the original bill. The new law provides for the renegotiation of contracts with various defense agencies, including the Department of Defense and its component departments, the Department of Commerce, General Services Administration, Atomic Energy Commission, Reconstruction Finance Corporation, Housing and Home Finance Agency and the Panama Canal. It is applicable to amounts received or accrued on contracts and subcontracts since January 1, 1951, where the work was performed after June 30, 1950. Application of the law is limited to receipts in excess of $250,000 during a fiscal year. (Certain promotional fees and commissions are subject to renegotiation when in excess of $25,000 in a year.) A Renegotiation Board of five members is created to handle renegotiations.

Of particular importance are the exemptions stated in the law. There are certain *mandatory* exemptions including contracts with public bodies, tax-exempt scientific and educational institutions, and common carriers and contracts for various agricultural commodities and in respect to certain durable productive equipment.

There are also *permissive* exemptions wherein the Board is authorized in its discretion to exempt from some or all of the provisions: (1) Contracts performed outside the United States or Alaska (2) contracts under which the profits can be estimated with reasonable certainty when the contract price is established, such as contracts for personal services, (3) contracts requiring not over 30 days work, (4) contracts whose provisions are, in the opinion of the Board, adequate to prevent excessive profits, and (5) contracts where necessary secrecy would be jeopardized by renegotiation or where in the opinion of the Board it is not administratively feasible to renegotiate. Contracts for personal services will probably be interpreted to refer to employment of an individual consultant and not to lump sum contracts for engineering service by a consulting firm.

A Board of Analysis for Engineering and Architectural Projects and Drainage Area Advisory Commissions would be created according to the provisions of a bill recently introduced in the Senate (S. 1144). Such a Board would consist of five members appointed by the President from persons outstanding in the engineering and architectural fields and would be concerned primarily with contemplated public works involving water problems. The President would also be authorized to appoint a Drainage Area Advisory Commission for each major drainage area. Such commissions would be made up of representatives of federal agencies and of the states concerned.

St. Lawrence Waterway (H.R. 2536) bills are being discussed in the House committee. To date the proponents of the plan have been heard; opponents will be heard commencing April 2. No hearings have been scheduled on the similar measure in the Senate.

Industrial Waste Treatment Works. A bill has been introduced in the House (H.R. 2752) to provide for accelerated amortization for tax purposes in connection with expenditures made by industry on industrial waste treatment works. No hearings have yet been scheduled. Reports on the proposal from government departments are being awaited.

Research Into the Health Hazards of Air Pollution is the subject of a resolution introduced in the House of Representatives (H.J. Res. 38) early this year. A new resolution (H.J. Res. 218) on the subject was introduced on March 22. No hearings have been scheduled. No corresponding measure has been introduced in the Senate.

An Amendment to the Davis-Bacon Act (S. 644) to extend its wage coverage to architects, engineers, draftsmen, and technicians has been introduced, but no hearings have been scheduled. The Senate Committee has requested reports from various agencies.

Fair Labor Standards Act of 1938. A bill has been introduced into the House (H.R. 2940), which would specifically exclude the making of plans and specifications in connection with professional architectural or engineering services from the operation of the Fair Labor Standards Act of 1938. No hearings have been scheduled.

The original Defense Housing Bill (S. 349) (see March CIVIL ENGINEERING, page 55) was refused consideration in the House and returned to committee. A new version drastically reducing the sums proposed has since been reported out of Senate Banking Committee and will soon be considered by the Senate (S. 349). The Senate bill now provides for $1\frac{1}{2}$ billion of FHA-insured mortgages in defense areas (compared with $3 billion originally proposed), $60 million in Federal loans and grants for community facilities, $60 million for land-acquisition and public-housing development in isolated defense areas where private capital will not provide housing, and $15 million for federal loans to prefabricated housing manufacturers. A two-year program is proposed.

Controls

N.P.A. order M-4, requiring licenses for commencing private commercial construction is in full operation. Revisions and explanations of the provisions of the order are constantly being made. Community and Y.M.C.A. buildings are covered, but schools, libraries, and churches are exempt. A recent revision permits increased expenditures for improvements and additions for hotels, department stores, office and loft buildings, without license (up to a cost of 25 cents per square foot of occupied space per 12 months). Eleven district offices, in addition to those mentioned in March CIVIL ENGINEERING (p. 55), have been empowered to approve applications. Public works are exempt from licensing, but such exemption does not give any assurance of obtaining needed scarce materials.

Regulation No. 4 permits priority assistance for obtaining supplies for maintenance, repairs, and operations. Department of Commerce offices throughout the country have information on NPA regulations.

The critical materials squeeze is on. For the second quarter of this year, manufacturers of fixtures, household appliances, automobiles and other non-defense products are restricted to 80 percent of the amount of steel used in the base 1950 quarter; aluminum fabricators may use 65 percent of that metal, copper users are restricted to 75 percent. The long-awaited Controlled Materials Plan for allocating these scarce materials to manufacturers will probably go into effect on July 1.

The Construction Branch of NPA, under Frank Creedon, is now composed of five divisions: Plant Loans, Amortization Certificates, Materials, Controls, Facilities Expansion. A Conservation Division, to foster savings of materials through design and construction practices, may be established soon.

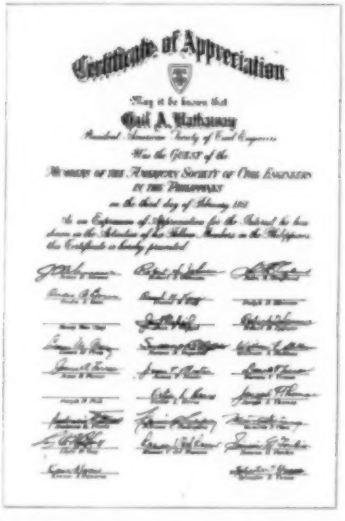
Washington, D.C.
March 26, 1951

President Hathaway Visits Metropolitan Section

ASCE PRESIDENT GAIL A. HATHAWAY (second from right), principal speaker at March meeting of Metropolitan Section, presents Service Certificate to William M. Griffin (at his right), who has just retired from ASCE Board of Direction. Shown left to right are Directors Kirby Smith, Morris Goodkind, and Waldo Bowman, Mr. Griffin, Mr. Hathaway, and Prof. William S. LaLonde, Jr., president of the Metropolitan Section. Mr. Hathaway, who recently returned from India where he headed the official United States delegation to the international engineering conferences, described progress being made in Indian water and power developments in illustrated lecture. Mr. Bowman, another member of the delegation, commented on socio-political factors affecting progress of the country.

President Hathaway in the Philippines

ITINERARY OF ASCE PRESIDENT GAIL HATHAWAY on recent trip to India where he headed U. S. State Department official delegation to international engineering conferences, included stop-over in Manila, P. I., where he was entertained by ASCE members living there and by the Philippine Society of Engineers. At right is reproduction of beautiful scroll signed by all ASCE members in Manila to commemorate his visit. In view below Mr. Hathaway is photographed with ASCE members in front of St. Augustine Church in Intra Muras.



Certificate of Appreciation

May it be known that

Gail A. Hathaway

American Society of Civil Engineers

Was the GUEST of the

Members of the Philippine Society of Civil Engineers

in the Philippines

on the third day of January 1951

In an Expression of Appreciation for the Interest he has shown in the Welfare of the Fellow Members in the Philippines, this Certificate is hereby presented

California Sections Plan Yosemite Conference

The California Conference of Local Sections, to be held in Yosemite National Park, May 3–5, will combine the advantages of a program of technical and Society speakers with opportunities for sightseeing in one of the most scenic national parks. This year the conference is sponsored jointly by the Sacramento and San Francisco Sections, with the Los Angeles and San Diego Sections also taking part.

In addition to a technical program featuring papers by three men prominent in West Coast engineering affairs, a lively business session will bring Society affairs closer to the average member. Several ASCE officers will take part in the business meeting, with President Gail Hathaway addressing the Friday evening banquet. A Student Chapter Conference, featuring a student paper contest as one of the main attractions, will be held under the sponsorship of the University of Santa Clara Chapter.

Reservations can be made by writing directly to the Yosemite Park and Curry Co., Yosemite National Park, Calif. All sessions will be at the Ahwahnee, and rates there are $15 a day for each person (two in a room) American plan. Lower American plan rates are available at Yosemite Lodge and Camp Curry with meals at the Ahwahnee. European plan rates are also available at Yosemite Lodge. Each request for reservations should be accompanied by a deposit of $10.

Coming Local Section Events

Arizona—Spring meeting in the Pioneer Hotel, Tucson, April 28, at 9 a.m.

Central Ohio—Meeting in the Chittenden Hotel, Columbus, April 19, at 6:15 p.m.

Cincinnati—Meeting in Cincinnati the first Wednesday of each month.

Colorado—Dinner meeting at the Democratic Club, Denver, the first Monday of each month.

Columbia—Meeting in Walla Walla, Wash., on April 12.

Dayton—Luncheon meeting at the Dayton Engineers' Club, April 16, at 12:15 p.m.

Florida—Meeting at the Seminole Hotel, Jacksonville, April 10, at 7 p.m.

Georgia—Luncheon meeting at the Atlanta YMCA, the first Friday of each month, at 12:30 p.m.

Illinois—Weekly luncheons every Friday at the Chicago Engineers Club, at 12 noon.

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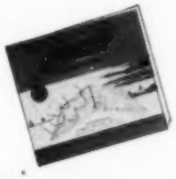

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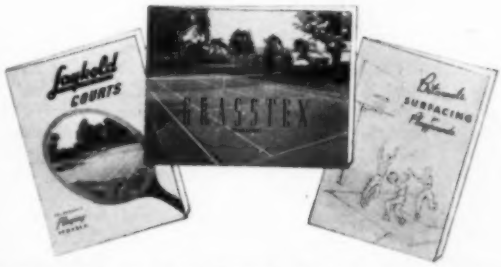

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For AIRFIELDS — a variety of paving methods for large or small airfields, with data, photos and results.

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- ☐ SAND-MIX PAVEMENTS

Intermountain—Meeting in Salt Lake City on April 20.

Kansas—Meeting in Manhattan, April 19, at 6:30 p.m.

Los Angeles—Dinner meeting at the Alexandria Hotel, Los Angeles, April 11, at 6:30 p.m., preceded by Junior Forum meeting at 6 p.m.

Maryland—Meeting in the Engineers Club of Baltimore, Baltimore, April 11, at 8 p.m., preceded by dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York City, April 18.

Miami—Dinner meeting in Miami at the Seven Seas Restaurant, April 15, at 7 p.m.

Michigan—Meeting at the Engineering Society of Detroit on April 12.

Northwestern—Meeting at the Coffman Memorial Union, University of Minnesota, the first Monday of each month.

Oklahoma—Dinner meeting of the Oklahoma City Branch in the YWCA Building, Oklahoma City, April 20, at 6:30 p.m. Meeting of the Tulsa Branch in the Chamber of Commerce Building, Tulsa, the first Monday of each month.

Philadelphia—Meeting at the Engineers Club, Philadelphia, on April 10. Meeting of Delaware Sub-Section on April 17.

Pittsburgh—Meeting at the Hotel Penn, Pittsburgh, April 17, at 8 p.m.

Sacramento—Regular luncheon meetings every Tuesday at the Elks Club, Sacramento, at 12:30 p.m.

Syracuse—Meeting in Syracuse on April 26.

Tacoma—Meeting in Olympia on April 10.

Tennessee Valley—Dinner meeting of the Knoxville Sub-Section at the S & W Cafeteria, Knoxville, April 11, at 6:15 p.m. Spring meeting of Section in the Civic Auditorium, Kingsport, Tenn., May 5, at 10 a.m.

Texas—Luncheon meeting of the Dallas Branch the first Monday of each month, at the Hotel Adolphus, at 12:15 p.m. Luncheon meeting of the Forth Worth Branch the second Monday of each month, at the Blackstone Hotel, at 12:15 p.m.

Wisconsin—Meeting at the University Club, Madison, April 26, at 6 p.m.

Scheduled ASCE Conventions

SUMMER CONVENTION
Louisville, Ky., June 13–15
(Board of Direction meets June 11–12)

ANNUAL CONVENTION
New York, N.Y., October 22–25

SPRING CONVENTION
New Orleans, La., March 5–7, 1952

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Akron	Feb. 8	11	Films on the "Natural Resources of Wyoming" and on city planning were presented.
Buffalo	Feb. 20	48	Col. H. W. Schull, Jr., district engineer, Buffalo District, Corps of Engineers, discussed surveys for redevelopment of the Niagara River.
Central Illinois	Feb. 20	41	Dinner meeting with Prof. H. E. Babbitt, of the University of Illinois, talking on "Administration of Sanitary Engineering in the United States."
Central Ohio	Feb. 15	41	Dinner meeting. Prof. Louis E. Vandegrift, of Ohio State University, gave a speech entitled, "Compressive Stress Distribution in Reinforced Concrete by Photoelastic Methods."
Colorado	Feb. 12	21	Civil defense was discussed by George B. Berger, director of civil defense, Denver, Colo., and Morton Gottschalk, assistant director.
	Mar. 12	49	Gene Britenstein outlined the many problems concerned with the allocation of Colorado River.
Dayton	Feb. 19	30	Luncheon meeting. Barton M. Jones gave a talk on his experiences in Peru while supervising development of hydroelectric project there.
District of Columbia	Feb. 13	112	In an address based on the President's Water Resources Policy Commission, Leland Olds, stressed the need for unity on river basin planning.
District of Columbia	Mar. 7	304	Annual dinner meeting given in honor of ASCE President Gail A. Hathaway, who spoke on the recent international conferences in India.
Florida Gainesville Sub-Section	Feb. 5	...	William N. Carey, ASCE Executive Secretary, led an informal discussion on Society activities pertaining to the national emergency.
	Feb. 22	...	Joint meeting with University of Florida Student Chapter. The New York transportation system was discussed by H. D. Winsor, retired engineer of New York.
Hawaii	Feb. 10	...	Ladies Night meeting. ASCE President Gail A. Hathaway was guest of Section.
Intermountain	Feb. 17	186	Luncheon and afternoon meeting. Inspection trip to the Geneva Steel Plant, Orem, Utah. At luncheon Parley R. Neeley, area engineer, Bureau of Reclamation, Spanish Fork, Utah, outlined the proposed Central Utah Project.
Indiana	Feb. 2	...	President Don M. Corbett acted as moderator for panel discussion on Local Section activities in connection with civil defense program.
Iowa	Mar. 8	125	Joint meeting with Iowa State College and State University of Iowa Student Chapters. An illustrated lecture on bridge design practice of the Iowa Highway Commission presented by engineers James Sassaman, Donald Bopp, Howard Lyon, Clinton Jones, Frank Schmitz, and Donald Schultz.
Kentucky	Feb. 2	78	Joint meeting with Kentucky Society of Professional Engineers. Prof. A. J. Meyer, director of aeronautical Research Laboratory, University of Kentucky, gave an address on "Gas Turbines and Jet Propulsion."
	Feb. 27	...	Dinner meeting. Col. Wm. N. Carey, ASCE Executive Secretary, delivered an address on "Engineers and Professional Unity."
Los Angeles	Mar. 14	148	Samuel B. Morris, chief engineer and general manager, Los Angeles Department of Water & Power, summarized the report of the President's Water Resources Policy Commission. Education for engineering was discussed by L. M. K. Boelter, Dean, College of Engineering, U.C.L.A.
Maine	Feb. 12	12	Dinner meeting featuring Brad Hixon, safety engineer, Liberty Mutual Insurance Co., Portland, as speaker.
Maryland	Feb. 14	97	Dinner meeting. Speakers included Arthur D. McVoy, director of Planning Commission, Baltimore, Md.; Richard L. Steiner, director of Baltimore Redevelopment Commission; and Oliver C. Winston, executive director of City Housing Authority.

Metropolitan	Feb. 21	...	Rear Admiral A. D. Alexis, CEC, USN, director of the Atlantic Division, Navy Bureau of Yards & Docks New York, presented a talk on "Construction, an Element of Logistics."
Miami	Feb. 8	66	Joint dinner meeting with Professional Engineering Association of Southeast Florida. William N. Carey, ASCE Executive Secretary, spoke on "Engineers and Professional Unity."
	Mar. 2	46	Ladies Night. Water, its conservation and control was discussed by Edmund Friedman, Nevin Hoy, and F. D. R. Park.
Mid-South Jackson Branch	Feb. 28	...	Dinner meeting with Neal G. Barfield, general secretary of Jackson YMCA, discussing Joint Council for Educational Development.
	Feb. 2	13	Engineers and professional unity was the topic of a talk by William N. Carey, ASCE Executive Secretary.
Northwestern	Feb. 5	49	Hibbert Hill, hydraulic engineer, Northern States Power Co., Minneapolis, Minn., reported on recent unification work of EJC. O. L. Kipp, assistant commissioner and chief engineer, Minnesota State Highway Department, discussed highway program.
	Mar. 5	34	Development of highways in foreign countries, particularly Thailand, was discussed by Harold Peterson and John A. Swanson, engineers for the Bureau of Public Roads.
Oklahoma Oklahoma City Branch	Mar. 8	50	John T. Gartrell, resident manager, Timber Structures, Inc., Kansas City, presented an illustrated talk on "Engineering in Wood."
Panama	Feb. 19	...	An illustrated lecture on woods was delivered by Hayward H. Shacklett.
Philadelphia	Feb. 13	...	Panel discussion on civil defense with Thomas Buckley, director of Public Works, acting as moderator. Speakers included Norman J. Cota, Melville J. Ashton, Henry B. Allen, and Lawrence Costello.
Pittsburgh	Feb. 27	70	Joint meeting with civil section of Engineers Society of Western Pennsylvania. William J. Cox, chief engineer, Pennsylvania Highway Planning Commission, talked on commission's classification program.
Providence	Feb. 8	40	Joint meeting with Rhode Island Society of Professional Engineers. Prof. Henry Campbell, Department of Civil Engineering, Rhode Island State College, gave a talk on industrial waste.
	Mar. 8	85	Joint meeting with Rhode Island Society of Professional Engineers, and the Student Chapters of Brown University and Rhode Island State College. A. L. Delaney, structural field engineer, Boston District of Portland Cement Association, spoke on prestressed concrete.
San Diego	Feb. 27	31	The political and economic status of the California engineer was outlined by E. L. Freeland, structural engineer of San Diego.
South Carolina	Jan. 19	32	Joint meeting with South Carolina Society of Engineers. W. T. Reedy, engineer, Sales Development Group, Rohm & Haas Co., Philadelphia, Pa., presented speech on plexiglass, and R. K. Mason, field project manager, E. I. DuPont de Nemours & Co., Augusta, Ga., discussed problems of construction management.
Syracuse	Jan. 22	...	Dinner meeting with Fred W. Fisch, deputy superintendent of New York State Department of Public Works, speaking on "The Thruway."
Tacoma	Jan. 13	82	Annual Ladies' Night dinner dance.
Texas Houston Branch	Jan.	...	Election of officers with George Lacey as president, E. N. Gustafson, vice-president, and A. S. Hatch, secretary-treasurer.
Tennessee Oak Ridge Sub-section	Jan. 18	13	Business meeting with discussion of 1951 program.
Tri-City	Jan. 23	37	W. H. Peterson, municipal sales manager, Eagle Signal Corp., Moline, Ill., spoke on "Modern Trends in Vehicular Traffic Control."

STUDENT CHAPTER NOTES

Manhattan College

A lecture on fireproofing and acoustics was delivered by John G. Hotchkiss, district engineer for the American Institute of Steel Construction, New York City, before a recent meeting of the Manhattan College Student Chapter. The meeting was preceded by a luncheon in Mr. Hotchkiss' honor. Newly elected officers include Rino M. Monti, president; Edward Hourigan, vice-president; John Walsh, secretary; and Thomas Stoddard, treasurer.

Norwich University

Thurman Dix, water commissioner of the City of Barre, Vt., was guest speaker at a recent Norwich University Chapter meeting. The Student Chapter now boasts 100 percent membership of those eligible to join.

Rocky Mountain Conference of Student Chapters

The Rocky Mountain Conference of Student Chapters will take place at the University of Wyoming's College of Engineering, Laramie, on April 21. Special events on the program include an open house tour of the campus, a luncheon sponsored by the Monolith Portland Cement Co., a student paper contest, and an evening banquet.

Texas A & M College

Drainage engineering was discussed by Oliver M. Carter, division engineer of the Southwestern Division of Armco Drainage & Metal Products Co., Houston, Tex., before a recent meeting of the J. T. L. McNew Student Chapter of Texas A & M College. Another recent speaker was T. R. Spence, manager of the physical plant of the A & M system.

ASCE MEMBERSHIP AS OF MARCH 9, 1951

Members	7,796
Associate Members	10,052
Junior Members	13,948
Affiliates	68
Honorary Members	38
Fellows	1
Total	31,903
(March 9, 1950	28,330)

NEWS BRIEFS . . .

Role of Construction in National Emergency Discussed at AGC Annual Convention

Planning how the construction industry can serve the nation best during the emergency was the principal business of the recent 32nd annual convention of the Associated General Contractors of America, which was held in Boston. More than 1,000 contractors from all parts of the country heard the problem discussed by leaders in industry, education, and government. In addition, they took part themselves in numerous panel discussions that explored ways of enabling the industry to execute its work most effectively.

Last year the industry completed approximately $28 billion in new construction. This year the volume of defense and essential civilian construction is expected to exceed $20 billion.

In a study of conditions and prospects for the next 90 days, based on a survey of AGC branches throughout the country, it was established that most general contractors are busy now, largely in completing projects that were started last year. In many parts of the country, however, general contractors expect considerable unused capacity in the near future, because defense construction is not expected to take up the slack in those areas when current projects are completed. In the highway construction field, in particular, much unused capacity was reported. The survey also revealed shortages in materials containing metals, in construction machinery, and in repair parts for existing machines.

Government Controls Explained

How government controls can be expected to affect the industry was explained in a leading talk by Frank R. Creedon, Assistant Administrator for Facilities and Construction of the National Production Authority. Telling the group that "The construction industry has a higher position now in the government than it ever had before," Mr. Creedon supplied answers to some of the questions about materials that have been bothering construction contractors. The most serious shortage is in steel, the key construction material, he said, despite plans for stepped-up production. Factors aggravating the current shortage include the expanded steelmill construction program, which requires a great deal of steel, and the shift from homebuilding to industrial work, which takes two or three times more steel than housing.

Major defense construction programs were explained in talks by Brig. Gen. C. H. Chorpening, M. ASCE, Assistant Chief of Engineers for Civil Works, Department of the Army, whose talk dealt with the civil works program in the present emergency; Maj. Gen. Lewis A. Pick, M. ASCE, Chief of Engineers, Department of the Army, who spoke on "The Current Program of the Corps of Engineers"; Rear Admiral Joseph F. Jelley, M. ASCE, chief of the Bureau of Yards and Docks, whose subject was "Navy Shore Support Today"; and James A. Anderson, M. ASCE, president of the American Association of State Highway Officials and commissioner of the Virginia State Highway Department, whose talk emphasized the importance of the nation's highways.

The large program of defense construction that lies ahead will leave some areas of the country "rather dry of work" and will force a migration of workers in the construction industry as other areas compete for both men and materials, according to Walter L. Couse, M. ASCE, of Detroit, retiring president of the AGC. He warned the construction industry not to accept new work without first making sure of the availability of all materials required for the job, and the timing of their delivery.

AGC-ASCE Joint Committee Meets

A meeting of the AGC-ASCE Joint Cooperative Committee, held during the convention, sought to clarify construction controls. It was the conclusion of the conference that, "Unless there is early clarification regarding some federal controls on construction and simplification of the procedure to secure necessary materials, considerable construction this year may be seriously delayed." Greatest confusion was seen as stemming from the use of Defense Orders requiring producers of construction supplies to set aside given amounts of their production for national defense work. Major steps to permit relief from this condition were urged by the group. This action calls for the NPA to set up machinery so that accurate and timely figures revealing the amounts of critical materials actually required to meet "DO" orders will be available. Greater coordination between the defense agencies, especially the new organizations and professional and industrial groups including ASCE, is also urged.

The Joint Committee reports that satisfactory progress has been made in revising and improving the Joint Conference Committee's Standard Contract Form for Engineering Construction. The work of revision was begun by the following AGC task committee: S. L. Fuller, M. ASCE, Pittsburgh, chairman; Ellsworth Appel, St. Louis; J. G. Bartholomew, Dallas, Tex.; Albert D. Blakeslee, New Haven, Conn.; Edward P. Coblentz, Baltimore; D. B. Fegles, Assoc. M. ASCE, Minneapolis; George Nilson, Great Falls, Mont.; Frank W. Robertson, Huntington, W.Va.; Lyman D. Wilbur, M. ASCE, Boise, Idaho; and F. B. Winston, Minneapolis.

This task group has submitted the new draft to the special ASCE committee named to work on the project. Members of the ASCE committee are R. N. Bergendoff, Kansas City, Mo., chairman; V. R. Dunlap, Philadelphia; Field Representative Joseph H. Ehlers, Washington, D.C.; C. M. Hearn, Washington, D.C.; R. A. Hill, Los Angeles; E. J. McGrew, Jr., New York City; T. W. Mermel, Washington, D.C.; M. N. Quade, New York City; Gustav

PRESENT AT MEETING OF ASCE-AGC Joint Cooperative Committee, held in Boston as part of AGC Annual Convention, are A. N. Carter, co-secretary of committee for AGC and manager, Highway Division, AGC; Eugene L. Macdonald, M. ASCE, New York City consultant; ASCE Vice-President Albert Haertlein, Gordon McKay Professor of Civil Engineering at Harvard University; ASCE Director Kirby Smith, co-chairman of Joint Committee for ASCE and vice-president, Raymond Concrete Pile Co., New York; Dwight W. Winkelman, co-chairman of Joint Committee for AGC and president of D. W. Winkelman Co., Inc., Syracuse, N.Y.; ASCE President Gail A. Hathaway; and AGC representatives George H. Atkinson, president, Guy F. Atkinson Co., San Francisco, and Lester C. Rogers, president, Bates & Rogers Construction Corp., Chicago.

Requardt, Baltimore; J. W. Taussig, New York City; and Ross White, Houston, Tex.

In view of the progress made on the contract form, the Joint Cooperative Committee is hopeful that the two task groups can also improve and bring up to date the "Standard Questionnaires and Financial Statement for Bidders for Engineering Construction," which has not been revised since 1925. Immediately following the Joint Committee's meeting, the AGC task group began a study of the form in the hope that it can be turned over to the ASCE with comments at an early date.

The next meeting of the Joint Committee is scheduled for Washington, D.C., in May.

AGC Installs New Officers

At the conclusion of the four-day program, Glen W. Maxon, of Dayton, Ohio, succeeded Mr. Couse as president of the AGC, and Arthur S. Horner, Assoc. M. ASCE, of Denver, Colo., was installed as vice-president.

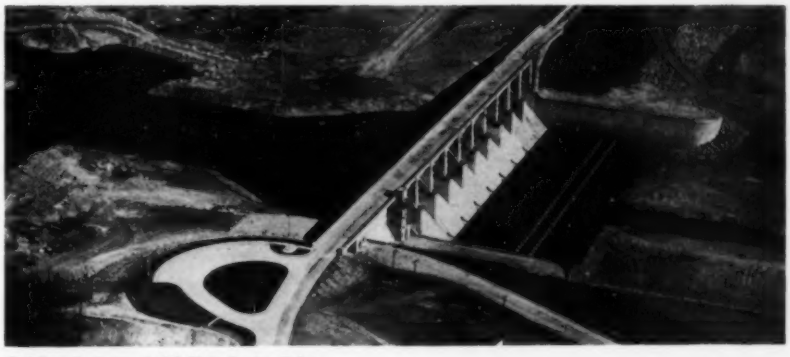
Overhead Express Highway Will Ease Boston Traffic

To expedite the congested traffic situation in downtown Boston, the Massachusetts Department of Public Works will build a $40,000,000 overhead express highway. Scheduled for completion in three years, the new highway will be the keystone of a projected $322,000,000 Boston Expressway Plan (CIVIL ENGINEERING for January 1949, page 18). Funds for the present project have been made available by allocations from two $100,000,000 highway bond issues authorized by the state legislature.

The first unit of the overhead expressway will be a bridge over the tracks of the Boston & Maine Railroad at the approach to its North Station terminal. From that point it will cross the city from north to south between the mercantile district and the waterfront. It will be entered by limited-access ramps along the way and will return to street level at Fort Hill Square, about four blocks north of the South Station Terminal of the New York, New Haven & Hartford and the Boston & Albany railroads.

In developing the Boston Expressway Plan, the bridge over the North Station railroad yards will have three other interconnections—one to the north connecting with routes to north central New England; one to the east joining the Mystic River Bridge for routes to northeastern New England; and one to the west joining the Storrow Memorial Highway along the Boston bank of the Charles River to points west and south. The Storrow Memorial Highway, which will be completed this summer, will be a link in the Boston Expressway Plan. A project of the Metropolitan District Commission, it is a surface expressway intended to relieve traffic congestion in the Back Bay section of the city. The Boston Expressway Plan will involve construction of 87 miles of limited-access routes, to be arranged like the spokes of a wheel radiating from an inner belt route encircling the downtown area.

Corps of Engineers Completes Hulah Dam in Oklahoma



© Delmer L. Curtis, Aerial Photo Service, Tulsa

CONSTRUCTION OF HULAH DAM on Caney River near Bartlesville, Okla., is completed by Tulsa District of Corps of Engineers. Authorized by Flood Control Act of 1936 and begun in 1946, project is unit of comprehensive reservoir system for Arkansas River Basin. Dam is rolled-earth fill type structure, 4,728 ft in length, exclusive of spillway, and height is 97 ft above stream bed. Ten 40-ft-wide gates control discharge through spillway. Built at total cost of $11,000,000, project will have maximum length of about 20 miles, width of two miles, and storage capacity of 295,000 acre-ft. Dam was built for Corps of Engineers by Mittry Brothers Construction Co., of Los Angeles.

Third Lincoln Tunnel Tube Planned by Port of New York Authority

Plans for the construction of a third tube of the Lincoln Tunnel under the Hudson River and new connections with state and municipal highways were released by the Part of New York Authority at a recent meeting of its board of commissioners. The new tube, to be built south of the existing twin tubes, will provide added capacity for 8,500,000 vehicles at the tunnel. Scheduled for completion in 1957 "barring total war," it will increase the annual capacity of the tunnel by 50 percent and will double its peak-hour capacity.

The over-all estimated cost of $85,000,000 includes $48,572,000 for construction of the tube; $18,826,000 for construction of new approaches and underpasses, rebuilding the plazas to the portals, and widening the streets in the area; and $12,000,000 for purchase of real estate. Interest costs will come to about $5,657,150.

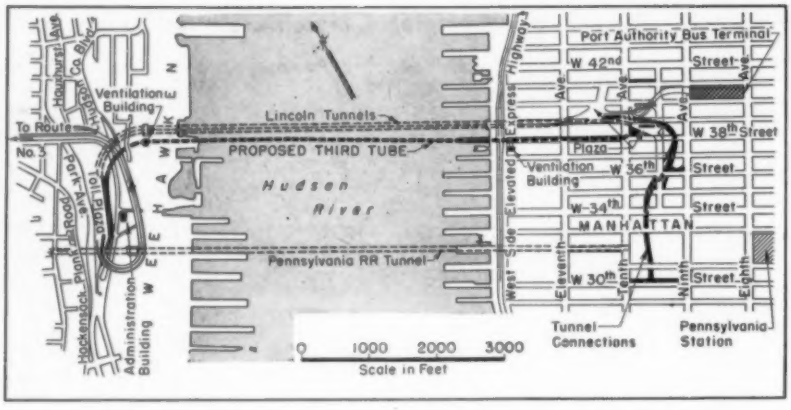
Located 97 ft below mean high water as are the present tubes, the new two-lane bore will be 7,944 ft from portal to portal and 31 ft in diameter. It will carry eastbound traffic, and the existing north tube will carry Jersey-bound traffic as at present. The middle, now the south, tube will be a reversible artery—eastbound in the morning and westbound in the evening.

Improvements in Manhattan will include eight connections between 38th and 30th Streets, tying into Dyer Avenue, which will have a separate combination underpass and new roadway to carry motorists from the city into the Lincoln Tunnel. Extensions to the crosstown streets and avenues in the tunnel area will make it possible to distribute tube traffic smoothly, whether or not a new crosstown artery is constructed. The approaches, underground cuts, and other construction will involve the purchase of almost $10,000,000 of real estate in the area between 41st and 30th Streets between Ninth and Tenth Avenues, and relocation of some 800 families.

Citing figures to show the inadequacy of the Lincoln and Holland Tunnels and the George Washington Bridge to handle peak traffic, Howard S. Cullman, chairman of the Port Authority, stated that, "The 1950 Lincoln Tunnel total of more than 15,500,000 vehicles represented the greatest gain in trans-Hudson traffic, an increase of almost 20 percent over the 13,000,000 vehicles handled in 1949." The new tube, he predicted, would be only the first in a series of additional crossings required to take care of expected traffic increases in the next ten years.

The rise in tunnel construction costs is best illustrated, according to Port Authority engineers, by a comparison of prices now and in 1934, when the original tunnel was started. Steel lining, which was $98 a ton, now costs $426. Tunnel bolts have risen from 5 to 15 cents a pound, and cast-iron lining from $41 to $186 a ton. Sandhogs now get $23 a day in comparison to $10 in 1934.

Ralph Smillie, M. ASCE, for the past five years chief engineer of the Triborough Bridge Authority, has been engaged to take charge of construction. A nationally known



PORT AUTHORITY PLAN for construction of third tube of the Lincoln Tunnel and new approaches and other improvements required in carrying out project is shown on this map.

tunnel expert, Mr. Smillie was chief designer of the existing Lincoln Tunnel twin tubes. He will work under John M. Kyle, Jr., chief engineer of the Port of New York Authority.

Railway Engineers Discuss Professional Shortages

Faced with the threat of a serious shortage of engineering graduates during the next decade, the railroads are attempting to attract graduates into the industry before it is too late, the American Railway Engineering Association was told in a report presented at the opening session of its three-day annual meeting in Chicago, March 13–15. S. R. Hursh, assistant chief engineer-maintenance of the Pennsylvania Railroad, presented the report, which included the results of studies by Ovid W. Eshbach, dean of Northwestern Technological Institute; J. B. Akers, M. ASCE, chief engineer of the Southern Railway System; and R. P. Davis, M. ASCE, dean of the College of Engineering of West Virginia University.

Efforts being made to establish suitable programs for recruiting selected graduates and for training and advancement of these men on individual railroads were described by Mr. Akers. Dean Davis told the group that railroads are furnishing lecturers to schools and providing student inspection trips to various parts of the railroad plant in order to stimulate interest in rail transportation among the colleges.

Other speakers at the three-day session included James H. Aydelott, vice-president in charge of the Operations and Maintenance Department of the Association of American Railroads, who brought out the fact that failure to allocate sufficient steel to the railroads coupled with difficulties encountered in obtaining even the steel allocated is seriously hampering the new freight car construction, maintenance, and improvement programs. Gerald M. Magee, research engineer for the Association of American Railroads, described a wide range of current research directed at improving roadbed, track and structures, and James A. Anderson, M. ASCE, Virginia Commissioner of Highways and president of the American Association of State Highway Officials, advocated adoption of public policies "to assure reasonable protection of our highly important highway system."

Tom A. Blair, M. ASCE, chief engineer of the Atchison, Topeka and Santa Fe Railway Co., Chicago, was elected president of the organization for the coming year.

Army Awards Contract for VA Hospital in New York

Award of a contract for construction of a 1,250-bed Veterans Administration hospital in New York City to the Cauldwell-Wingate Corp., of New York, is announced by Maj. Gen. Lewis A. Pick, Chief of Engineers. Located at East 23rd Street and First Avenue, the hospital will be the 44th and final unit to be placed under construction in the list of postwar VA hospital projects assigned to the Corps of Engineers. The contract is for approximately $19,000,000.

President Appoints National Science Foundation Head

Dr. Alan T. Waterman, chief scientist of the Office of Naval Research, has been named by President Truman as director of the National Science Foundation. The engineers on the Board are Edward L. Moreland, M. ASCE, consultant, Jackson & Moreland, Boston, Mass.; Andrey A. Potter, dean of engineering, Purdue University; and Donald H. McLaughlin, president, Homestake Mining Co. Because of his duties as Defense Mobilization Director, Charles E. Wilson has resigned from the Science Board.

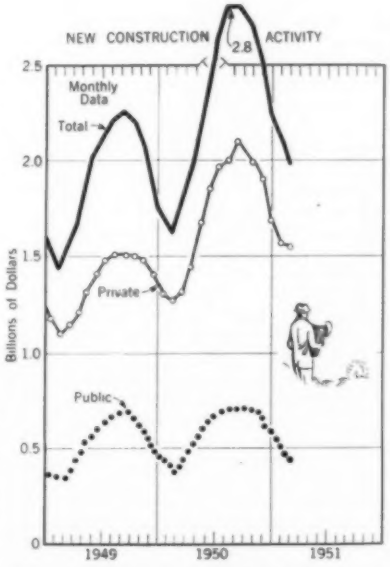
Construction for February Exceeds Records for Month

Construction activity during February 1951 exceeded all previous February records, according to a recent joint report of the Building Materials Division of the U.S. Department of Commerce and the Labor Department's Bureau of Labor Statistics. The total value of new construction put in place amounted to near $2 billion, an increase of 22 percent above the February 1950 total. Most types of structures were being built in greater volume than a year ago, including homes, factories, stores, office buildings, churches and schools, as well as highways, sewer and water facilities, and of course military and naval installations.

The total value of privately financed construction put in place during February was $1,545 million, 22 percent above February last year. The dollar volume of industrial building was almost double the February 1950 rate, and commercial building was up by almost 60 percent. Private residential building, up by 20 percent, was valued at $864 million and accounted for 57 percent of total private outlays for new construction.

Public construction expenditures, valued at $435 million, were also 22 percent above February 1950, with all major types of activity contributing to the increase.

The output of building materials is reported to have declined less than seasonally in November from the October 1950 level. The Department of Commerce composite index of building materials production was 173.4 for the month (1939 = 100). Production of nearly all the materials included in the index declined slightly. On a seasonally adjusted basis, however, the November index was 175.0, compared with 168.3 in October, and the over-all output was at the highest November level on record.



DEPARTMENT OF COMMERCE CURVES for February show construction rise of 22 percent above February 1950 total.

Report of President's Water Policy Committee Completed

The President's Water Resources Policy Commission, appointed in January 1950 to study and make recommendations on policies in the field of water resources, together with existing legislation, has just released to the public the last two of its three-volume report. Volume 1, which presents a 70-point program of recommendations for a national water policy, has already been announced (January issue, page 72).

Now available are Volume 2 of the report, containing detailed and comprehensive studies of the plans, potentialities, and problems confronting river basin development in ten major river basins of the country, and Volume 3, an exhaustive study of water resources law. Copies of each volume may be purchased from the Superintendent of Documents, Washington 25, D.C., at the following prices: Volume I, $3.25; Volume 2, $6; and Volume 3, $2.25. A Summary of Recommendations sells for 15 cents.

With completion of the report, the seven-man commission, headed by Morris L. Cooke, has been dissolved. Other members of the Commission were R. R. Renne, president of Montana State College; Lewis W. Jones, president of the University of Arkansas; Gilbert White, president of Haverford College; Samuel B. Morris, M. ASCE, of the Los Angeles Department of Water and Power; Paul S. Burgess, dean of the University of Arizona College of Agriculture; and Leland D. Olds, of New York.

Metallurgical Advisory Board Is Established

Formation of a board of leading industrial and academic metallurgists to advise the Research and Development Board of the Department of Defense on research aspects of some of the nation's critical metal problems is announced by the National Research Council. The work of the new Metallurgical Advisory Board will be directly in the interest of national security since metals in huge quantity are essential for modern military operations.

Organized by the National Academy of Sciences and the National Research Council under a contract with the Research and Development Board, the new group will advise the Board on the correlation, coordination, interpretation, and application of metals research and development programs of the military services and suggest new research projects. In addition, it will collect and distribute useful information obtained by the establishment of close liaison with the professional societies, governmental agencies, and academic and industrial organizations devoted to metals and their use.

Preliminary work by the Metallurgical Advisory Board is already in progress on research and development phases of three of the most urgent metal problems: Critical and strategic metals and their substitutes; the application of metals to be used at high temperatures; and the development of the currently small titanium industry. Other metals in critically short supply listed tentatively for the study of the board are columbium, tantalum, cobalt, molybdenum, tungsten, and beryllium.

The chairman of the 18-man board is Dr. Robert F. Mehl, head of the Department of Metallurgy at Carnegie Institute of Technology.

Building Code Revisions Proposed by New York State

Suggested improvements in local building laws are set forth by the New York State Building Code Commission in a proposed code for one- and two-family dwellings and a 280-page illustrated manual indicating acceptable construction methods and test procedures for acceptance of alternate methods under the code.

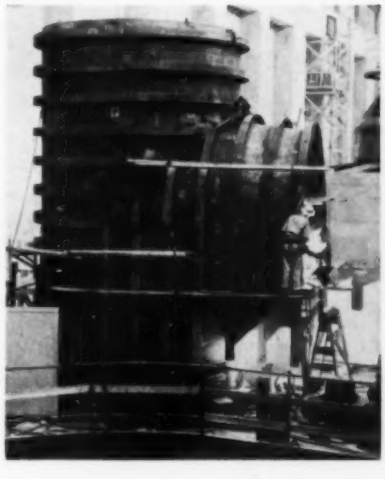
Drafted in accordance with the performance concept urged by code authorities as the solution to the faults found in the familiar specification code, the proposed code sets forth the structural, fire-safety, and sanitation requirements to be attained, and the criteria for acceptance of compliance. These criteria are based on research carried on by testing laboratories and other organizations over a long period, and are said to represent advanced architectural and engineering practices. The code manual is issued in illustrated form to assist building officials, engineers, architects, builders, and others in the interpretation, application, and enforcement of provisions in the code.

Copies of the proposed code and manual are being distributed for review to 1,567 municipalities of the state and to more than a thousand engineering, architectural, contracting, and building-material manufacturing organizations.

Simple Solutions Found for Caracas Building Problem

INGENIOUS SOLUTIONS to construction problems posed by local conditions and new building codes are being found by engineers in Caracas, Venezuela. With coming of automobile traffic to city, which is notorious for its narrow streets and frequent hills, street surface was leveled wherever possible by simple cut, leaving sidewalks in many places almost 10 ft above streets. Subsequent zoning laws providing for 10-ft setbacks of all new construction created gaps in continuity of sidewalk in many localities, which must be bridged to keep people off streets. At present surplus Bailey Bridge sections or simple trestles, as shown here, are being used to provide sidewalk continuity and compliance to zoning law. This material is supplied by M. D. Morris, Jun. M. ASCE, and published through courtesy of "Ingenieria Internacional Construccion."

Valve Discharge Liner for Hoover Dam Power Plant



GIANT PRESSURE RELIEF VALVE discharge liner is assembled for generating unit A-4, now being installed by Bureau of Reclamation in Hoover Dam power plant. Manufactured by Allis-Chalmers Co., liner weighs 65,000 lb, stands 26 ft high, and is 14 ft in dia. Too bulky for shipment in one piece from factory in West Allis, Wis., liner arrived in sections, which are being welded together in photo. After assembly, liner will be lowered into place in A-4 wheel pit, rim of which is shown in foreground, and concreted into place. Scheduled to go into production late in 1951 or early 1952, three new generating units will complete installation in Arizona wing of powerhouse, raising plant's capacity to 1,249,800 kw. Photo courtesy of Bureau of Reclamation.

Increase in Aluminum Production Reported

Evidence of the aluminum industry's efforts to expand primary production for defense needs as rapidly as possible is reflected in figures announced by Donald M. White, secretary of the Aluminum Association, revealing an increase of more than 4,000,000 lb in February over the previous month, and almost 32,000,000 lb, or 31 percent, over January. Production of primary aluminum reached 135,907,016 lb in January, as compared to 131,794,258 lb in December.

"The increase did not come from any of the new facilities which the industry has scheduled, but which will take several months to construct," Mr. White explained. "During January high-cost stand-by capacity was reactivated under special arrangement to produce metal for the national stockpile."

Conservation of Waste Paper for Defense Urged

To meet the critical shortage of waste paper, needed for the production of paper and paperboard for military and civilian use, the Midwest Consumers of Waste Paper urges careful conservation of this vital raw material. Despite greatly expanded production of paper and paperboard, the organization points out, waste paper receipts during the past year have increased only slightly. With the further demand made on the industry by defense needs, business and public needs will go unfilled unless additional waste paper can be made available, the organization states. A wartime survey quoted shows that two pounds of paper and paperboard products were required for each $5 the government spent for defense.

Practical suggestions for conservation call for (1) saving every scrap of waste paper; (2) making arrangements with a waste paper dealer for disposal; and (3) getting waste paper into circulation as rapidly as possible.

Adoption of Modular Coordination Predicted

Efforts to prevent further increases in building costs, the possibility of a shortage of workers in some building trades, and the desire to prevent unnecessary waste in the use of building products will hasten the adoption of modular coordination during the emergency, according to A. Naughton Lane, president of the Producers' Council. "Modular coordination saves both time and materials in construction because materials used in combination are dimensioned to fit together with a minimum of costly cutting and patching," Mr. Lane emphasized.

"In addition to savings realized in construction and materials," he stated, "architects save time through the use of modular design, and additional time is saved on the job site through simplification of layout problems. Adoption of modular coordination also permits smaller inventories, because there eventually are fewer sizes to keep in stock, thus tying up less critical material. A number of large postwar buildings have been designed and built on the modular basis, and studies are under way to determine the full extent of the savings effected."

The development and adoption of modular coordination is a joint project of the Producers' Council and the American Institute of Architects, under the sponsorship of the American Standards Association.

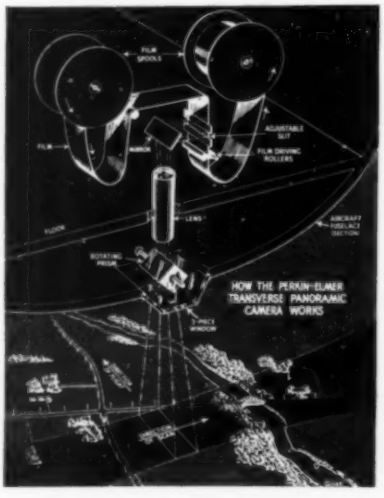
New Aerial Camera Permits Speedy Mapping of Large Areas

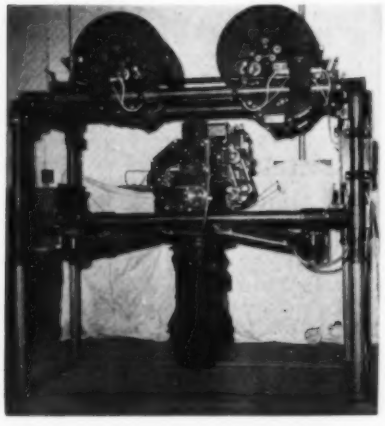
A single, aerial camera, so large that it could photograph the entire state of Pennsylvania in less than a day on one very large roll of film at an altitude of 40,000 ft, has been designed and developed for the U. S. Air Force by the Perkin-Elmer Corp., of Norwalk, Conn. Called the Transverse Panoramic Camera, the new instrument can perform work that previously required a battery of from two to five cameras weighing thousands of pounds.

In the present design, which is an application of the U. S. Air Force strip camera principle, only one camera is used. It is fixed and does not move. The heart of the design is a huge 90-lb glass prism that hangs beneath the lens of the camera and rotates in a semi-circle, scanning the terrain from horizon as much as 180 deg. Mounted in a reconnaissance airplane, the new camera successively photographs strips of terrain below and across the line of flight of the airplane, from horizon to horizon, on a roll of film 18 in. wide and from 200 to 5,000 ft long, depending on the space and carrying capacity of the airplane in which the camera is installed. Each scan of the camera can give a picture 18 in. wide and from 2 to 10 ft long, depending on the altitude of the airplane. Details such as railroad ties and shadows show up clearly in the 30 by 60-ft picture that can be developed from the film.

The controls are semi-automatic. Before pictures are taken, the speed and altitude of the airplane carrying the camera are set on a control panel. A computer-like mechanism determines the speed at which the prism turns and the interval between each scan. The rolls of film turn slowly, building up several feet of slack below the narrow slit where the exposure actually is made. Once the prism begins its scan, the slack length of film moves rapidly across the exposure slit in synchronization with the movement of the prism. Only a 2-in. length of film is exposed at any one moment, and a total of several feet can move across the slit in less than 2 sec. Each picture can be as much as 10 or 12 ft long, depending on the altitude. Exposures are timed so that successive strips overlap, photographing each ground object twice from different angles. In actual flight, the camera can take up to ten pictures a minute, depending on the altitude of the airplane. It is estimated that an area 400 miles long and 100 miles wide could be photographed in a little over an hour.

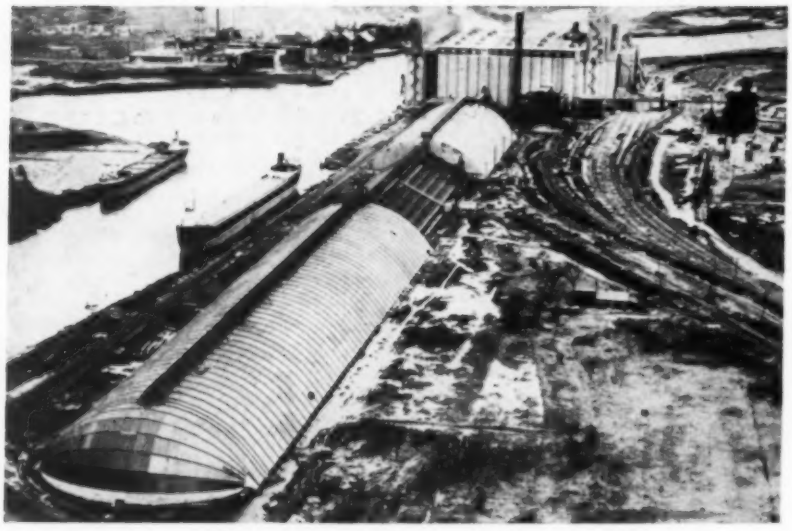
Although the Transverse Panoramic Camera is designed for use in large bomber-type aircraft, its weight and bulk-saving features combined with the fact that it provides wide, lateral photo coverage make it valuable also for use in small fighter-type aircraft.





TRANSVERSE PANORAMIC CAMERA, developed by Perkin-Elmer Corp. for U.S. Air Force at suggestion of Dr. James G. Baker, of Harvard University, was worked out in cooperation with Photographic Laboratory in Engineering Division, Air Materiel Command Wright Field, Dayton, Ohio.

Huge Steel Bin Is Designed for Grain Storage



THIS ENORMOUS GRAIN-STORAGE BUILDING, recently completed in Chicago, constitutes one of world's largest all-steel structures. By addition of two sections to an existing storage unit, Cargill Inc., has expanded the storage capacity of its Calumet River plant by 7,500,000 bu. Designed by Cargill engineers, both new units are constructed of Steelox panels and are 220 ft wide by 60 ft high. The extension in the foreground is 900 ft long, and the other 450 ft. Housing the conveyor system, which runs along the top of the entire structure, is a Steelox shed roof building 10 ft high, 12 ft wide, and 1,900 ft long. Project required more than 350,000 sq ft of steel panels.

Production of Power for Defense Studied at Reclamation Conference

The progress and problems of Bureau of Reclamation construction in 17 Western states were critically reviewed by the Bureau's construction administrators at the second annual Construction Engineers' Conference, held at the Denver Federal Center during the week of February 12–16. In particular, emphasis was given to ways to speed production of additional hydroelectric power needed for the defense effort.

Assistant Commissioner Goodrich W. Lineweaver, of the Washington office of the USBR, discussed the impact of the current emergency on the Bureau's construction program for the next fiscal year. He pointed out the likelihood of the program's being keyed to power production and of the continuance of important irrigation work. The Bureau has requested a construction appropriation of about $225,000,000 for the 1952 fiscal year—about $100,000,000 less than this year's appropriation. Ansbert C. Skina, chief of the construction expediting branch of the Defense Power Administration, outlined the situation regarding defense orders and the increasing shortages of materials.

Steps being taken to promote mutual understanding between engineers and contractors were described by George Atkinson, president of the Guy F. Atkinson Co., of San Francisco, in a talk on "Engineer-Contractor Relationships." In a detailed resume of contracting practices, he analyzed several major issues that have caused misunderstanding between engineers and contractors. Both groups, he emphasized, must encourage the training of younger men towards a better understanding of each others' rights and viewpoints if contractual teamwork is to continue.

Working Briefs for Engineers Prepared by Carnegie Tech

Issuance of the first of a projected series of *Carnegie Notebooks in Civil Engineering* is announced by the civil engineering department of Carnegie Institute of Technology. The first publication—"The Long and Short of Conduits," by F. T. Mavis, M. ASCE, and T. E. Stelson and E. H. Miller, Junior Members ASCE—was intended as an experiment in dealing briefly and informally with basic problems in hydraulic engineering and in reporting some of the current work of faculty and students. Other *Notebooks* on topics in hydraulic engineering, structural engineering, and applied mechanics are being prepared.

For the convenience of teachers, students, and other engineers who are interested in studying as they practice, the first publications—and others still in the mill—are being made available for general distribution at nominal cost to cover printing and handling. Copies may be ordered from the Civil Engineering Department, Carnegie Institute of Technology, Pittsburgh, Pa., at 25 cents each.

Fellowships in Welding Are Made Available

Predoctoral research fellowships to provide young men of demonstrated ability an opportunity to conduct basic research in applied sciences relating to welding and closely allied fields are being administered by the Welding Research Council of the Engineering Foundation under its University Research Committee. The fellowships are supported by the International Harvester Co., the Chicago Bridge & Iron Co.; Linde Air Products Co., and others. Each fellowship will carry an award of $3,500 to be divided between the stipend to the fellow, tuition for postgraduate work, and materials, apparatus and supplies.

Any university desiring to apply for one of the fellowships should indicate the type of problem that it wishes to undertake, the name of the faculty adviser, and complete information in regard to candidates. Inquiries and application should be addressed to W. Spraragen, director of the Welding Research Council, 29 West 39th Street, New York 18, N.Y., and should be received not later than June 1.

Engineering Bibliographies Issued by E. S. Library

The series of bibliographies on subject of general interest, compiled by the staff of the Engineering Societies Library, have proved helpful to so many engineers that the complete list is being given here for the benefit of those who have not seen earlier announcements.

No. 1. Filing Systems for Engineering Offices. 41 references. 1948. $2.

No. 2. Prestressed Reinforced Concrete. 190 references. 1948. $4.

No. 3. Precision Investment Casting by the Lost Wax Process. 111 references. 1949. $2.50.

No. 4. Pallets Used in Modern Materials Handling. 114 references. 1949. $2.

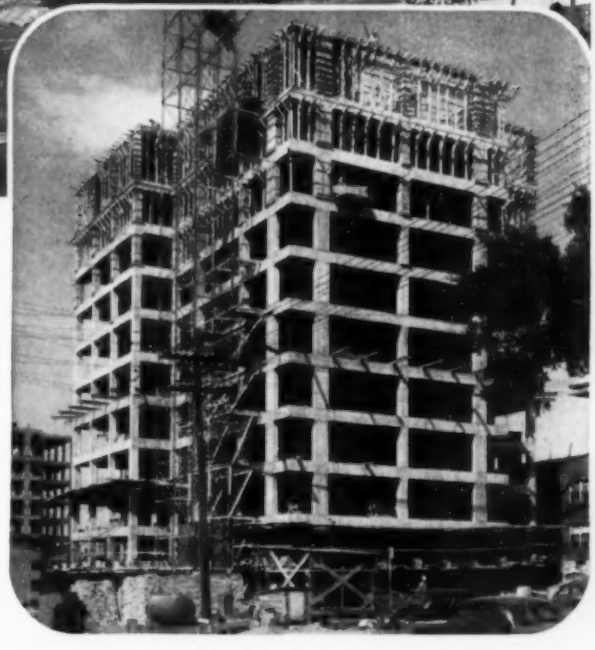
No. 5. Machinery Foundations; Design, Construction, Vibration Elimination. 120 references. 1950. $2.

No. 6. Non-Metallic Bearings. 101 references. 1950. $2.

No. 7. Domestic and Industrial Applications of Solar Heating. Approximately 150 references. 1950. $2.

No. 8. Management of Construction Jobs. Approximately 52 references, 1950. $2.

Inquiries should be addressed to the Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.



Concrete Frames and Floors

effect important savings in construction costs

The Quality Hill Towers Apartments in Kansas City are an excellent example of quality construction combined with unusual economy. The economy resulted from the use of reinforced concrete frame and flat plate floor construction.

Competitive bidding has shown, again and again, that concrete frames and floors effect big savings in construction costs—savings in time, money and materials. These savings are possible in tall buildings such as the Quality Hill Towers Apartments as well as in structures of only a few stories.

Concrete frame and floor construction has proved its economy in structures of all types and uses—apartments, schools, hotels, hospitals, industrial plants and public and office buildings. Reinforced concrete construction gives buildings the strength to resist all static and dynamic loads at the lowest cost and produces durable, sturdy and firesafe structures. Because they are moderate in first cost, require little or no maintenance and give long years of service, reinforced concrete frame and floor structures are examples of true ***low-annual-cost*** construction. This makes them a sound investment for owners, investors and taxpayers.

General view, top, shows in foreground the five 10-story Quality Hill Towers Apartment buildings under construction. On Jefferson St., from 9th to 11th, in walking distance of downtown Kansas City, they contain about 400 units. Owners: Riverside and River Park Development Corp. Architects: J. F. Lauck & Associates. Structural engineer: Whitman Dart. Contractor: Winn-Senter Construction Co.

For additional information in designing and building economical reinforced concrete frames and floors, write today for free copies of two useful booklets, *"Continuity in Concrete Building Frames"* and *"Handbook of Frame Constants."* These booklets are distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

DEPT. A6-13, 33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

N. G. Neare's COLUMN

R. Robinson Rowe, M. ASCE

"I was just wondering," mused Professor Neare, "if any of the technical committees of this Engineers Club had critically reviewed the design of gimmicks. I would have mentioned it, but Sauer Doe just nudged me as a reminder that he's Guest Professor for the simple tream problem."

"And I'm curious to see if it's too simple for Joe Kerr," replied Professor Doe.

"Just simple enuf," retorted Joe. "I wasn't bothered too much by the units, ig and uk, tho I suppose they are gimmicks to keep me from using a handbook. The maximum moment in the simple tream is $\frac{1}{4} \cdot 10 \cdot 100 \cdot 1.1 = 275$ ig-uk, which requires a section modulus of 27.5 uk³. Unfortunately the 9-uk tream has a section modulus of only $729/32 = 22.78$, so you couldn't use it, and I hope you didn't."

"Let me tell Joe something," begged Ken Bridgewater. "Way back in 1754 Bill Emerson taught that a triangular beam was stronger if you adzed its apex. The optimum width of the upper base is given by the cubic $b^3 + 45b^2 + 567b = 729$, so that $b = 1.17356$ uk and $S = 24.88$ uk³. Overstress would be negligible if we eliminated impact by limiting speed to 5 uk per az."

"Good," said Professor Doe. "The Emerson gimmick is a bright idea, but still it isn't quite good enuf."

"Then let's combine it with the Doe gimmick," suggested Cal Klater, "by turning the tream until its base is vertical. At first, $S = 729/16\sqrt{3} = 26.31$, which is still scant, but when we adze 0.5 uk from top and bottom apices, $S = 16\sqrt{3} = 27.71$. So Q.E.D."

"Quite so. Now what do you think, Noah? Do we know our gimmicks?"

"A few," conceded Professor Neare, "and I can see that you know a gimmick when you see one, which is more than Webster did. Stein would have said, 'A gimmick is a gimmick, is a gimmick,' but how would Webster have defined it? Thanks, Sauer, for this lesson on gimmicks and treams. Now, for our next lesson, Stoop Nagle will be our Guest Professor again. More gimmicks, Stoop?"

"A gimmick is where you find it," warned Professor Nagle, "but this is only a simple-sounding sequel to the classical bear problem. You remember that a hunter met a bear a mile south of his camp, chased it a mile west before he killed it, then had to drag it a mile to his camp,—the question being, 'What color was the bear?' Well later, while moving his camp 146 yd south to a more sheltered spot, he shot a second bear which was looting his old camp, and this bear ran 99 yd south and 47 yd east before it died. How far did the hunter probably have to drag it to his new camp?"

[Cal Klaters were James R. Bole, Abbot Sackheim, and Elisabeth F. Gittings. Also acknowledged are ingenious solutions from M. W. Jackson, Franklin Randall, A. D. Locitzer and G. Nyuss (Robert M. Dodds), the latter, for example, speculating that Ozian timber was so much lighter than Ozian air that buoyancy would offset the apparent overload. Guest Professors Sauer Doe and Stoop Nagle are Marvin A. Larson and John L. Nagle.]

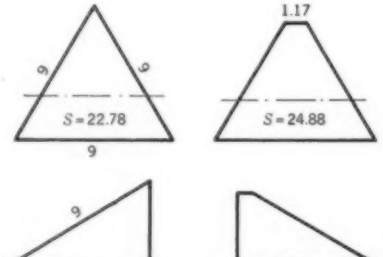


FIG. 1. TECHNIQUE OF turning and trimming the tream.

Positions Announced

Naval Ordnance Test Station, California. Civil and electrical engineers are needed to do work in connection with planning and design of ordnance test ranges at the Naval Ordnance Test Station, Inyokern, China Lake, Calif. This work covers the planning of buildings, power facilities, inter-communication facilities, roads, and various specialized test facilities. Salaries range from $4,600 to $5,400. Applicants need not have established Civil Service eligibility. Minimum qualification requirements: B.S. in appropriate fields, or equivalent, plus two to four years experience. Applications on Form 57 or correspondence should be directed to the Head, Employment Division, Naval Ordnance Test Station, Inyokern, China Lake, Calif.

U.S. Civil Service Commission. Applications are being accepted by the U.S. Civil Service Commission for Cartographic Aids, and Engineering, Cartographic, and Statistical Draftsmen (Grades GS-2 through GS-7), in federal agencies in Washington, D.C., and vicinity, with yearly salaries from $2,450 to $3,825. Full information and application forms may be secured from any Civil Service Commission office or local post office, or from the U.S. Civil Service Commission, Washington 25, D.C.

Holloman Air Force Base, New Mexico. Announcement of a vacancy for a mathematician or civil engineer with a good background in mathematical theory of geodetic and astronomical surveying, is made by the Holloman Air Force Base, New Mexico. The position, which pays from $3,100 to $6,400, is under Civil Service. Other details may be obtained from Irene Price, Acting Chief, Technical Staff, Holloman Air Force Base, New Mexico.

U.S. Civil Service Commission. Vacancies exist in various agencies of the federal government in Washington, D.C., and vicinity. Positions range from GS-9 level through GS-12, with starting salaries from $4,600–$6,400 per annum. Inquiries and requests for civil service application forms should be made to the U.S. Civil Service Commission, Washington 25, D.C.

State Department of Public Health, Washington. The Washington State Department of Public Health announces openings for public health and senior public health engineers, with monthly salaries ranging from $343–$471. To qualify, applicants must have graduated from a recognized college with an engineering degree and have one year of graduate study or equivalent in experience. Inquiries should be addressed to the State Personnel Board, 1209 Smith Tower, Seattle 4, Wash.

California Conference Studies Emergency Highway Building

How to build streets and highways in the present emergency drew the attention of more than 500 engineers and officials attending the recent Third California Conference on Street and Highway Problems at the University of California in Berkeley. To stop building highways would be a blow to defense preparations was the conclusion of the experts addressing the three-day meeting, which was sponsored by the Institute of Transportation and Traffic Engineering.

C. H. Purcell, Hon. M. ASCE, California Director of Public Works, urged road men to ready their M-Day plans. "M," he said, might stand for either mobilization or maintenance, but in any case should encompass four elements: (1) An all-out effort to hold present highway, road, and street systems together, (2) better road management, (3) better service from personnel, and (4) continued research.

Frank E. Landsburg, district director of the Interstate Commerce Commission, Portland, Oreg., urged states and cities to form emergency transportation committees utilizing the most informed men in the various transportation fields. He also urged immediate removal of bottlenecks in strategic supply routes. "We have not been realistic," he said, "when we have built other highways and left those bottlenecks in our main lines of supply."

Indiana rejuvenates a worn highway

21 miles of US-6 are undersealed and resurfaced with Texaco Asphalt

When Indiana decided last year to recondition 21 miles of US Route 6, it was not satisfied with half-way measures. Before constructing a new asphalt wearing surface over the old concrete pavement, the state highway department specified that all voids which had developed under the pavement be filled with asphalt, thus restoring full support to the slab.

The material used to fill voids was a Texaco Asphalt of 25-35 penetration, which road builders have pumped under a substantial mileage of old concrete and found ideal for the purpose. Approximately 105,000 gallons were needed to fill all voids under this 21-mile highway.

For the new wearing surface, Indiana called for a plant-mixed asphalt pavement laid in two courses, each $1^1/_2$ inches thick. Gravel was employed as aggregate, with a Texaco Medium-curing Cutback Asphalt serving as binder in the mix. Emulsified asphalt was used to prime the old concrete pavement and to seal the new asphalt surface.

Today, with available road funds failing to keep pace with increasing traffic demands, it is more important than ever that America protect its investment in existing highways. As demonstrated on Indiana's US-6 project, Texaco Asphalt products help salvage old, worn paving just as effectively as they help construct new highways.

Two helpful booklets which describe all types of Asphalt construction for streets and highways can be secured without charge by writing our nearest office.

Constructing two-course Texaco Asphaltic Concrete pavement on 21 miles of US-6 in northern Indiana, after the old pavement was undersealed with a 25-35 penetration Texaco Asphalt. View of completed project at right. Undersealing by Fenton Construction Company, Ashland, O. New surface laid by Brooks Construction Company, Fort Wayne, Ind.

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TEXACO

REG. T. M.

TEXACO ASPHALT

NEW IN EDUCATION

Carnegie Institute of Technology announces the availability of teaching assistantships, graduate fellowships, and research assistantships in civil engineering for the academic year, 1951–1952. The teaching assistantships are open to qualified graduate students and carry a remission of tuition and fees amounting to $600 and cash stipends ranging from $750–$1,100, depending upon duties. Part-time research assistantships carry stipends comparable to teaching assistantships, and full-time research assistants may carry approximately one-third of a normal load of graduate work, usually in evening classes, with remission of tuition. Applications should be submitted to the Dean of Graduate Studies, College of Engineering and Science, Carnegie Institute of Technology, Pittsburgh 13, Pa.

With the award of a recent $1,700,000 building contract to the White Construction Co., of New York City, Cornell University will start construction of a laboratory for the study of materials and methods of processing them. The second unit in the university's engineering development program initiated in 1940, the center will consist of two laboratories, one for materials and the other for processing.

Half-time graduate assistantships are available in the department of civil engineering at Michigan State College. The stipend is $1,000 for the academic year; tuition and fees are waived. Holders of these assistantships will normally be able to complete the requirements for the M.S. degree in two years. Letters of application together with transcripts of previous academic work should be forwarded to Dr. C. O. Harris, Head, Civil Engineering Department, Michigan State College, East Lansing, Mich.

To meet the present emergency, the Schools of Engineering and of Mines at the University of Pittsburgh will conduct a regular twelve-week summer semester from June 18 to September 7 for freshman, sophomore, junior and senior students. The summer program for these students will be part of the total program in which they are enrolled. Courses will be offered as they are justified by enrollment.

Interior partitions which include provisions for storage are to be studied by the Small Homes Council of the University of Illinois under a $4,650 research grant from the Lumber Dealers Research Council. The purpose of the study, which will cover a twelve-month period, is to prepare recommendations for construction of closet-wall units that can be adapted to any price-class house, new or old. They will be modular in dimension (divisible by 4 in. or multiples of 4 in.), and will be flexible in construction and in choice of materials.

Yale University's Bureau of Highway Traffic is accepting applications for eleven graduate fellowships for the study of traffic engineering during the academic year, 1951–1952. Each of the fellowships provides $1,400 covering tuition for one year, as well as a stipend for individual research projects. The awards are open to men who hold an engineering degree from an accredited college. Nine of the fellowships are made available through a grant from the Automotive Safety Foundation, one from the American Transit Association, and another from the Rand McNally Co., of Chicago, Ill. The latter, known as the Rand McNally Fellowship in Traffic Engineering, is being offered for the first time.

DECEASED

Wesley Richard Bray (M. '49) who recently became assistant chief engineer of the Scranton-Spring Brook Water Service Co., Scranton, Pa., died on February 23, at the age of 48. Except for about three years as chief of operations for the Puerto Rico Aqueduct and Sewer Service, in San Juan, Mr. Bray had been in the employ of the utility since 1926. He was a graduate of Northeastern University.

Chotalal Chunilal Dalal (M. '48) of Mashirabad, Hyderabad, D.N., India, died recently. He was 57 and a graduate of Bombay University. Mr. Dalal's engineering career included work as assistant engineer for the Public Works Department in the Nelgonda, Nizambad, and Medak districts; assistant engineer on construction of the Nizamsagar Canal and Reservoir; and executive engineer on the Wyra and Palair projects. Later he became assistant and executive engineer of the Asifabad District.

Frank Holliday Derby (M. '38) design engineer in the Tennessee Valley Authority's chemical engineering office at Wilson Dam, died in Florence, Ala., on February 8. His age was 65. A graduate of the University of Maine, Mr. Derby began his career with the U. S. Reclamation Service. After service in the Army during World War I, he joined the Washington University Department of Civil Engineering in St. Louis, becoming assistant professor in 1926 and associate professor in 1930. He had been on the staff of the TVA since 1941.

George Francis Devereux (Assoc. M. '31) assistant structural engineer in the design department of the Stone & Webster Engineering Corp., Boston, Mass., died in Lexington, Mass., on January 24. He was 62 and a graduate of the University of Vermont. Earlier in his career Mr. Devereux had been connected with the Davis & Farnum Manufacturing Co., at Waltham, Mass.; the Boston & Maine Railroad, in Boston; and the New England Power Construction Co., Boston. He also worked for the American Bridge Co.

Owen Bert French (M. '03) retired professor of engineering, died in Lakewood, Ohio, on February 1, at the age of 85. He was a graduate of Case Institute of Technology. For a number of years Mr. French was in the employ of the U.S. Coast & Geodetic Survey, for which he did primary triangulation from the 39th parallel to Puget Sound. He was professor of geodetics at George Washington University from 1920 until his retirement in 1933. He also engaged in private consulting work.

Albert Preston Harness, Jr. (M. '48) president of the Jennings-Lawrence Co., Columbus, Ohio, died there on February 7. His age was 55. In 1918 Mr. Harness entered the employ of the Jennings-Lawrence Co., as draftsman and transitman, and subsequently became chief draftsman, vice-president and general manager, and president of the firm. His work included design and construction of the $3,000,000 sewerage-expansion program for Franklin County (Ohio). Active in civic affairs, he had served as chairman of the Chamber of Commerce Committee on Metropolitan Planning and the Regional Planning Commission.

Arthur Hirst (Assoc. M. '02) of Glen Ridge, N.J., died recently, at the age of 79. Mr. Hirst spent his engineering career with the American Bridge Co., and its affiliate organization the Pencoyd Iron Works.

Theodore Temple Knappen (M. '36) internationally known civil and hydraulic engineer, of New York City, died on March 20, at the age of 50. Senior partner in the firm of Knappen Tippetts Abbett Engineering Co. since 1942, Mr. Knappen had handled numerous foreign engineering assignments. He was a graduate of the U.S. Military Academy at West Point, class of 1920, and had served as a lieutenant in the Army Corps of Engineers. In 1928, after work with private engineering firms, he rejoined the Corps of Engineers in a civilian capacity, specializing in flood control work. From 1937 to 1942 he was with the firm of Parsons, Klapp, Brinckerhoff & Douglas, New York consultants, organizing and managing the firm's South American office in Caracas, Venezuela. He was author of many papers on soil mechanics and hydraulics and had written on construction projects for CIVIL ENGINEERING.

Affiliated photo–Conway

Theodore T. Knappen

Jacobus Kappeyne (M. '20) consulting engineer with Barker & Wheeler, of New

(*Continued on page 72*)

Deceased

(*Continued from page 70*)

York City, died at his home in Brooklyn, N.Y., on February 22. He was 68. Mr. Kappeyne was formerly city engineer of Washington, D.C., and with the New York State Public Service Commission. He had also served as valuation engineer for several railroads and utilities in Alabama, Illinois, and New York, and for some time had a consulting office. He was a Zurich University graduate.

Otis Furman Lewis (Assoc. M. '14) retired civil engineer, of Babylon, N.Y., died on January 15, at the age of 76. He received his engineering training at Union College. At the beginning of his career Mr. Lewis had been connected with the Department of the State Engineer and Surveyor of New York. In 1921 he joined the New York State Department of Public Works, Division of Highways, becoming assistant highway engineer in 1932. He retired in 1941.

Charles Holland Moritz (M. '07) of Buffalo, N.Y., died sometime ago, although word of his death has just reached Society Headquarters. He was 72. Mr. Moritz had been with the Pittsburgh Reduction Co., at Niagara Falls, N.Y., and the Aluminum Company of America. He received his engineering education at the University of Michigan.

John Reed (M. '20) retired civil engineer, of Waterville, Me., died there on January 15, at the age of 87. He was a University of Maine graduate. Mr. Reed held positions of responsibility in connection with the construction of railroads in the United States, New Zealand, the Philippine Islands, and several South American countries. During World War I he was senior engineer in the Eastern District of the Bureau of Valuation, Interstate Commerce Commission, with headquarters in Washington, D.C. He retired from active practice in 1923.

John Clement Remington, Jr. (Assoc. M. '14) civil engineer with offices in Camden, N.J., died on March 7, at the age of 66. He graduated from the Drexel Institute of Technology. For the past five years Mr. Remington had been engineer for Ocean County (New Jersey). He had also served as engineer for numerous municipalities in New York, New Jersey, and Pennsylvania.

Thomas Edward Ringwood (M. '32) of Washington, D.C., died recently. He was 55. Mr. Ringwood had been connected with the Montauk Beach Co., Inc., of Montauk, N.Y., serving successively as vice-president, chief engineer, and trustee. From 1941 to 1945 he was on duty as a lieutenant colonel in the Marine Corps. He then engaged in private consulting practice. He attended the University of Minnesota School of Mines.

Edward Hugh Schulz (M. '19) retired army officer, died at his home in Berkeley, Calif., on March 3. His age was 78. Upon his graduation from West Point, Mr. Schulz was commissioned in the Engineer Corps. He was appointed district engineer of Guantanamo, Cuba, in 1905 and erected defenses for the naval station in that area. From 1907 to 1916 he was in charge of the improvement of the Missouri River, and later supervised the Mississippi passes at New Orleans. Colonel Schulz also had been division engineer of Hawaiian harbors, the North Pacific Coast Division, and the Great Lakes Division.

Josiah Baldwin Rutter (M. '25) former vice-president of Monsanto Chemical Co., Everett, Mass., died at Naples, Fla., on January 26, at the age of 58. In 1922 Mr. Rutter was appointed chief engineer of the Merrimac Chemical Co., at Boston, Mass., and six years later was transferred to St. Louis as chief engineer of the Monsanto plant there. He directed the development of the organization's synthetic rubber program. He retired in 1949 as general manager of Monsanto's Merrimac Division at Everett. He received his training at Tufts College.

J. B. Rutter

Benjamin Alvan Sleeper (Assoc. M. '16) for about 50 years a member of the consulting engineering firm of Sherman & Sleeper, at Camden, N. J., died at his home in Burlington, N. J., on February 21. He was 66. An authority on riparian water rights, Mr. Sleeper had been city engineer of Beach Haven and other New Jersey resort communities.

William Haiber Spirz (Assoc. M. '41) civil engineer in the bridge department of the California Division of Highways, San Francisco, died on February 16, at the age of 48. He was a graduate of the University of California. Mr. Spirz worked on the construction of the San Francisco-Oakland Bay Bridge and the San Rafael Viaduct. He was a veteran of World War II.

Armour LaMont Stanley (Jun. M. '41) for some time sales engineer for the Harnischfeger Corp., at Minneapolis, Minn., died recently. He was 33 and a graduate of the University of Minnesota.

Albert Davis Taylor (M. '42) landscape architect and town planner, of Cleveland, Ohio, died on January 8. His age was 67. Mr. Taylor received his engineering degrees from Massachusetts State College and Cornell University, where he taught landscape architecture at the start of his career. From 1908 to 1914 he did topographic work for W. H. Manning, at Pinehurst, N. C. He entered private practice in 1915 and since that time had been engaged as consultant by Cleveland and Cincinnati on public improvements.

Lawrence Edward Van Etten (Assoc. M. '99) civil engineer, of New Rochelle, N.Y., died on January 28, at the age of 85. He graduated from Princeton University in 1886 and was immediately engaged in railroad construction work. In 1889 Mr. Van Etten became associated with Horace Crosby. A year later he established his own business in New Rochelle, where he laid out most of the community's park system and real estate subdivisions and designed numerous golf courses.

Paul Voorhees (M. '22) retired civil engineer, died recently at his home in Little Neck, N.Y. He was 91 and a graduate of Rensselaer Polytechnic Institute. For many years Mr. Voorhees was connected with the Reading Railroad, having charge of construction at Reading, Pa. He was also superintendent of the Beaver Creek Water Co., retiring in 1929. He also engaged in private practice.

James Wilson Grimes Walker (M. '04) of Brownfield, Me., died recently, at the age of 82. Upon his graduation from the Massachusetts Institute of Technology Mr. Walker entered the railroad construction field. He was on duty with the Civil Engineer Corps of the Navy from 1898 to 1912, retiring as a commander.

Fred Morrell Zeder (M. '41) vice-president of the Chrysler Corp. in charge of engineering, at Detroit, Mich., died in Miami, Fla., on February 24. His age was 64. An outstanding leader in the development of the automobile, Mr. Zeder had been with the Chrysler Corp. since its founding and had been vice-chairman of the board of directors. Earlier he was employed by the Allis-Chalmers Co., as erecting engineer, and the Studebaker Corp., as chief engineer. For three years he acted as president of the Zeder-Skelton-Breer Engineering Corp. He had advised on many engineering projects and recently was vice-chairman of the Mackinac Bridge Authority. He was a University of Michigan graduate.

NEWS OF ENGINEERS

L. O. Stewart, professor and head of the department of civil engineering at Iowa State College and secretary of the Iowa Section of ASCE, was recently presented the Dunlap Award of the Iowa Engineering Society for the best technical paper published in the *Exponent*, official publication of the society. The paper was entitled, "The Future Professional Standing of the Engineer."

Horace P. Hamlin, designing engineer for the Raymond Concrete Pile Co., New York, N.Y., has been appointed consulting civil engineer. Mr. Hamlin has been connected with the organization for 43 years. **William P. Kinneman,** who has been assistant civil engineer for the firm, has assumed new duties as chief civil engineer.

James P. Slater, for the past two years sanitary engineer of the City-County Health Department, at Tulsa, Okla., has been engaged in a similar capacity by San Diego, Calif.

(*Continued on page 76*)

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Are you finding it increasingly difficult, in the face of today's economy, to undertake needed water-line construction?

If so, you may find—as other planners do—that Transite* Pressure Pipe can help provide a practical answer to your problem. For this pipe, in addition to its continuing, long-term savings, offers an opportunity for economies in installation *that may go far in helping you contend with rising costs and manpower shortages.*

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Assembly, too, is both rapid and economical. The flexibility of Transite's joints permit the pipe to be laid around wide curves without the need for special fittings. The Simplex Couplings require no calking or hot compounds; they are quickly and easily assembled to provide lastingly tight joints. *And with this pipe you can check for proper assembly immediately after the pipe ends are joined.*

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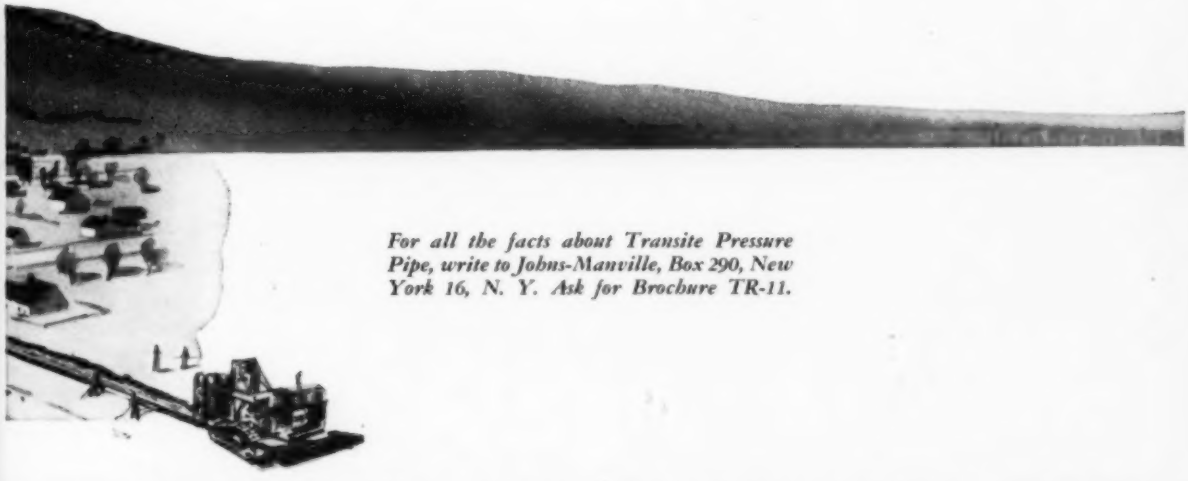
This combined feature of rapid assembly and assurance of joint-tightness as fast as the line is laid, is the key to an important Transite advantage: it means that trench excavation, pipe laying, and backfilling operations can follow in quick succession—often under the supervision of one foreman. It makes pipe-laying virtually an assembly-line operation in which the trench can be closed in a minimum of time. This assures more economical use of excavation and earth handling equipment, reduces the expense and hazards of long stretches of open trench, and helps button-up the job with the least possible expenditure of time, labor and money.

These *initial* savings . . . plus the *long term* economies that have been effected in thousands of installations . . . are two good reasons why you should have the complete story about this modern asbestos-cement pipe developed and produced by Johns-Manville to carry water more efficiently and more economically.



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News of Engineers

(*Continued from page 72*)

K. M. Pattee, formerly chief of the Supply and Procurement Division of the New York District of the Corps of Engineers, New York, N.Y., has been named chief of the newly activated Supply and Procurement Division of the New England Division of the Corps, at Boston, Mass.

Ingolf Erdal has retired as a member of the firm of Hazelet & Erdal, consultants of Cincinnati, Chicago, and Louisville. The business of the firm will be continued under the same name by **Craig P. Hazelet** and **A. L. R. Sanders** with **Lewis G. Hexem, Robert W. Wood,** and **John H. Clark, III,** as associates.

Charles A. Howland was recently honored with a medal and citation for "meritorious public service" from the American Public Works Association during the Metropolitan-Philadelphia chapter meeting. For a number of years Mr. Howland has been with the City Planning Commission as chief of the Division of Projects in Philadelphia. He is secretary-treasurer of the Society's Philadelphia Section.

Hibbert M. Hill, previously hydraulic engineer for the Northern States Power Co., at Minneapolis, Minn., has been appointed to the newly created post of chief engineer, in charge of all of the company's engineering and design work. His experience includes such positions as hydrographic and geodetic engineer, U.S. Coast & Geodetic Survey; instructor in civil engineering at the University of Minnesota; and senior engineer in the U.S. Engineer Office at St. Paul. Mr. Hill was president of the Society's Northwestern Section in 1935.

Hibbert M. Hill

Julian Hinds, chief engineer and general manager of the Metropolitan Water District of Southern California, at Los Angeles, has accepted an appointment as consulting engineer for the United Water Conservation District of Santa Paula, Calif. The district is contemplating development of storage of the Sespe and Piru creeks to overcome overdrafts on the Santa Clara River, particularly in the Oxnard-Hueneme district where sea water intrusion is becoming a serious problem. Mr. Hinds served the Society as Director from 1948 to 1950.

John H. Bringhurst, for several years chief engineer of the American Republics Corp., at Houston, Tex., has retired.

D. B. Steinman, New York City consultant and authority on bridge design and construction, has been awarded the Egleston Medal of the Columbia Engineering School Alumni Association, Columbia University, for the year 1951. Presentation will be made at the annual dinner of the association scheduled to be held late in April.

Bradford N. Clark, who has been on the staff of Eggers & Higgins, New York City architects, since 1946, has been appointed an associate in the firm. Mr. Clark will be responsible for construction and production, as well as a newly created industrial division.

William T. Field, president of the Watertown, N.Y., consulting engineering firm of Field, Emerson & Morgan, announces a change in the firm name to William T. Field Associates, Inc.

James W. O'Connor and **J. W. Gulledge** have become field engineers for R. G. LeTourneau, Inc., of Peoria, Ill.

T. R. Simpson, until recently senior hydraulic engineer for the California State Department of Public Works, at Sacramento, Calif., has become professor of irrigation in the college of engineering at the University of California, succeeding **Prof. S. T. Harding,** now emeritus.

William Henry Allison, professor of civil engineering at Clarkson College, Potsdam, N. Y., has been named chairman of the civil engineering department there. Professor Allison will also serve as chairman of the Upper New York section of the American Society for Engineering Education. He joined the faculty in 1929 and became professor of civil engineering in 1947.

Karl A. Sinclair has been reappointed to the post of city engineer at Honolulu, Hawaii, and **Arthur Akinaka, Jr.,** Honolulu contractor, has been named superintendent of building.

John E. Gragg and **J. D. Mahoney, Jr.,** announce the formation of a partnership for the practice of engineering under the name of Mahoney & Gragg, with offices in Dallas, Tex.

John F. Seifried, district manager of Ceco Steel Products, Chicago, Ill., is new chairman of the Chicago Advisory Committee for the Engineering Societies Personnel Service, Inc.

Otto W. Peterson, for 30 years manager of the general construction department of the Pacific Gas and Electric Co., San Francisco, Calif., has retired. Mr. Peterson directed the construction of the Super Inch pipeline.

Alfred D. Yanda, formerly traffic analyst and highway engineer in the Central Viaduct - Inner Belt Freeway Planning Office, Cleveland, Ohio, is now a partner in the Verne M. Clark Engineering Co., civil engineers, consultants, and surveyors, of Cleveland. Mr. Yanda has aided development of freeways and highways in Florida and Ohio. Active in Society affairs, he is now serving as president of the Cleveland Section.

Alfred D. Yanda

Robert A. Fredricks, who has been serving as junior highway engineer for the New Jersey Highway Department, has been appointed office engineer at Easton, Pa.

Felix A. Ciampa and **Alexander C. Youngson** have formed a partnership under the firm name of Youngson & Ciampa, with offices at 140 Cedar Street, New York City.

C. M. Hathaway, for the past two years chief highway engineer for the Illinois State Department of Public Works and Buildings, at Springfield, recently resigned because of ill health after 38 years of service. Mr. Hathaway will be retained in a consulting capacity.

Walter L. Leach and **Harry H. Moseley** have been admitted to partnership in the consulting firm of Havens & Emerson, engineers of Cleveland and New York. Other changes include the advancement of **Frank S. Palocsay** and **Edward S. Ordway** to principal engineers.

D. B. Yarbrough, formerly of Dallas, Tex., has been recalled to duty with the Army Engineers at Fort Belvoir, Va.

W. Orme Hiltabidle, Jr., captain, CEC, USN, has been promoted to the rank of rear admiral. At present Admiral Hiltabidle is district public works officer for the Fifth Naval District, with headquarters at Norfolk, Va. He served as public works officer at the Pearl Harbor Naval Shipyard from 1941 to 1943. As officer-in-charge of the Fifth Naval Construction Brigade and island engineer for Guam, he directed the $300,000,000 base-development program there. He is a member of the executive committee of the ASCE Waterways Division.

Admiral Hiltabidle

P. E. Barber, Jr., of the Humble Oil Co.'s Gulf Coast Division office in Houston, Tex., has been transferred to the East Texas Division office in Tyler.

G. W. Marx, director of the Division of Sanitary Engineering for the Arizona State Health Department, at Phoenix, has been appointed chairman of the Advisory Council of the Colorado Basin Engineers, dealing with Colorado River pollution control.

Rufe B. Newman, Jr., has accepted the position as director of the Construction Control Division of the Facilities Construction Bureau, National Production Authority, with headquarters in Washington, D.C. For some time Mr. Newman served as deputy commissioner for construction in the Bureau of Community Planning, FWA.

F. W. Beard has been admitted as a partner in the consulting firm of Freese, Nichols & Turner, with headquarters at Houston, Tex.

(*Continued on page 78*)

JUST OFF THE PRESS

Bulletin #9041... 32 pages of data, photos and drawings in color describing the Dorrco Hydro-Treator... the high-rate water treatment unit that gives these results

PLANT	JUNCTION CITY, KANSAS	LOCKLAND, OHIO	APPLETON, WISCONSIN	A CANADIAN PAPER CO.	T.V.A., SHEFFIELD, ALABAMA
OPERATION	SOFTENING	SOFTENING	SOFT. COLOR & TURB. REM.	COLOR REM.	ALGAE & COLOR REM.
NO. & SIZE OF UNITS	2–35' DIA.	1–31' DIA.	1–45' DIA.	2–80' DIA.	1–50' DIA.
CAP. PER UNIT, M.G.D.	1.5	1.0	3.1	10.0	3.0
GAL/SQ. FT./MIN.	1.08	.93	1.35	1.34	1.07
AVG. TURB. EFF. PPM	LESS THAN 0.2	5.0	2.4 TO 4.7	3 TO 5	4 TO 7
SLUDGE–% SOLIDS	35 TO 46.5	24.9 TO 39.2	16.7	–	–

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News of Engineers

(Continued from page 76)

Noah E. Hull, since 1946 plant engineer for Hughes Tool Co., Houston, Tex., has become vice-president and general manager of the newly formed Hughes Gun Co., a subsidiary.

John P. Riley has been granted a year's leave of absence from his duties as director of development of the New York City Housing Authority, to accept appointment to the newly created post of coordinator of school construction for the Board of Education.

Van Rensselaer P. Saxe is now practicing engineering at 100 West Monument Street, Baltimore, Md. Previously, he was connected with the firm of Saxe, Williar & Robertson, of Baltimore.

Marvin C. Nichols, who is associated with Freese, Nichols & Turner, at Fort Worth, Tex., was honored recently as "engineer of the year" by the Texas Society of Professional Engineers of that city. Mr. Nichols was cited for his "untiring efforts on behalf of the engineering profession and unselfish service to this society and his fellow engineers. . . ."

Warren Carlson left New York on March 9 for Barranca-Bermeja, Colombia, to work as refinery engineer for the Tropical Oil Co., a subsidiary of the International Petroleum Co., Ltd., at their refinery there. Mr. Carlson was formerly at the University of Tulsa, and before that with the Standard Oil Company of Indiana.

Guy H. Goddard, engineer, Caribbean Air Command, Albrook Air Force Base, C.Z., recently received word from headquarters in Washington, D.C., of his promotion to the rank of colonel. Colonel Goddard has served as operations officer of the 935th Engineer Aviation Group. During World War II he commanded an Aviation Engineer Battalion in the Southwest Pacific. He recently received his master's degree in civil engineering from Texas A. & M. College.

Air Force Photo

Col. G. H. Goddard

John P. Gnaedinger and **Theodore W. Van Zelst,** under the firm name of Gnaedinger & Van Zelst Labquip Corp., have been named distributors for the Tinius Olsen Testing Machine Co. Their activities with the Soils Testing Services, Inc., of Evanston, Ill., will continue.

George R. Brown, executive vice-president of Brown & Root, Inc., Houston Tex., has been named to the United States Board on the Materials Policy Commission.

Worrell F. Pruden, since 1945 chief engineer of Consolidated Western Steel Corp., at Los Angeles, Calif., has been made assistant chief engineer of the Columbia Steel Co., a subsidiary of U.S. Steel Corp.

Louis Goodman, since 1938 engineer for the New York City Board of Water Supply, has retired. Earlier Mr. Goodman was engaged in various capacities in the Department of Water Supply, Gas and Electricity, and the Department of Finance, and taught at the College of the City of New York. He did private consulting work for several years.

Applications for Admission to ASCE, Feb. 3–Mar. 10

Applying for Member

Adams, Andrew, Augusta, Me.
Angelotte, James Alois, Miami, Fla.
Atchison, Robert Howard, Milwaukee, Wis.
Atwood, Paul Elliott, Bangor, Me.
Barrett, Theodore Harvey, Houghton, Mich.
Billings, Chester Arthur, Evanston, Ill.
Black, Matthew B., Annville, Pa.
Bugge, William Adair, Olympia, Wash.
Currie, George James, Halifax, N.S., Canada.
Davenport, Arthur Winthrop, Richmond, Va.
Davidson, Stephen Mark, Denver, Colo.
Davis, Paul Douglas, Albany, N.Y.
Desbarats, George Henry, Newfoundland, Canada.
Dinsmore, Oliver Raymond, Olympia, Wash.
Earwell, Knight Dick, Chicago, Ill.
Erwin, Charles Oder, Las Vegas, N.Mex.
Farona, Louis, New Haven, Conn.
Frey, Rudolf Alfred, São Paulo, Brazil.
Garstka, Walter Urban, Denver, Colo.
Graham, Howard Orr, Cedar Rapids, Iowa.
Granlund, Ernest Viktor, Westwood, Mass.
Hammack, Earl William, St. Louis, Mo.
Haworth, Rader White, Charleston, W.Va.
Krewatch, Samuel, Signal Mountain, Tenn.
Kupper, Charles Joseph, New Market, N.J.
MacLeod, James Leslie, Bangor, Me.
Marshall, Harry Leslie, Seattle, Wash.
Mason, George Albert, Tacoma, Wash.
Matthews, Samuel Pollock, Ardmore, Okla.
Miles, Raymond Thomas, Rockville Centre, N.Y.
Morehouse, James Henry, Pittsburgh, Pa.
Nybye, Franz Cowan, Pasadena, Calif.
Pehel, Sigmund John, Brooklyn, N.Y.
Rettig, George John, Chicago, Ill.
Ruhl, Robert Calvin, Fort Wayne, Ind.
Salmon, Gordon Wood, Norfolk, Va.
Steuerman, Sergey, New York, N.Y.
Strayer, Lloyd Winfield, New Castle, Pa.
Van de Greyn, Engel Bert, Santa Fe, N.Mex.
Vaughn, Eugene Hilton, Jr., ECA, Greece.
Whitman, Karl Ewart, Halifax, N.S., Canada.
Zemitis, Elmars Julius, Dover, Del.

Applying for Associate Member

Adkins, George Gordon, Silver Spring, Md.
Bergh, Sverre Eriksson, Wilmington, Del.
Bhuyan, Rama Kanta, Baton Rouge, La.
Bouchereau, Jacques Charles, Pittsburgh, Pa.
Bustamante Miranda, Angel Rene, Estado Miranda, Venezuela.
Cadogan, Denis, Municipality, Singapore.
Dunbar, Marion Frank, Morgantown, W.Va.
Firth, Richard LaFountain, New York, N.Y.
Getty, Hugh Cecil, Little Rock, Ark.
Godfrey, Michael Francis, Washington, D.C.
Goldsmith, Robert Herman, New York, N.Y.
Gregory, David Lawson, Abbeville, Ala.
Gupta, Ajay Kumar, West Bengal, India.
Gustafson, Paul Norman, Pittsburgh, Pa.
Hackert, Earl Paul, Thief River Falls, Minn.
Holowka, Jerome, Juneau, Alaska.
Jones, Barton, Santurce, Puerto Rico.
Kong Sunn, Franklin Young, Honolulu, Hawaii.
Lavik, Olav, Knoxville, Tenn.
Lowrie, Charles Robert, Jr., Lafayette, Ind.
Mane, Yeshwant Rao Ganpat Rao, Shri Chhatrapura, India.
Marcello, Angelo Antonio, Cranston, R.I.
Poffenbaugh, William John, Jr., Chattanooga, Tenn.
Rivas-Mijares, Gustavo, Caracas, Venezuela.
Ropke, John Charles, Bergenfield, N.J.
Rutens, Boris, Dover, Del.
Silvey, Joseph Kran Gwynn, Denton, Tex.
Sitaramin, Krishnaswamy, Bhopal State, India.
Steusloff, Lester Arthur, Toledo, Ohio.
Therianos, Andrew Dimitriou, Athens, Greece.
Thoms, Meredith Ethel, Seattle, Wash.
Walker, Charles Leroy, Emory, Tex.
Webster, Arthur Garfield, Jr., New Castle, Del.
Williford, Howard Kent, State College, Miss.
Zaharin, Sergei Alexander, San Francisco, Calif.

Applying for Junior Member

Arhippainen, Esko, Helsinki, Finland.
Box, Harry Marland, Kansas City, Mo.
Bucklund, Kenneth Arthur, Escanaba, Mich.
Campomanes, Napoleon Villareal, Pittsburgh Pa.
Causing, Humbert Rodriguez, Princeton, N.J.
Crawford, Carl Benson, Evanston, Ill.
de Castro, Cresenciano Cruz, Ithaca, N.Y.
Demopulos, Chris, Shreveport, La.
Dietrich, Edwin Jerry, Oceanside, Calif.
Eagleson, Peter Sturges, Bethlehem, Pa.
Gonzalez, Felix Mangahas, Quezon City, Philippine Island.
Henger, Charles Gordon, Dallas, Tex.
Libby, Roscoe Woodbury, Caribou, Me.
Ramm-Ericson, Ulf, Annapolis, Md.
Ross, Graham Lindsay Drury, Cape Town, South Africa.
Sanchez Mora, Jose A., Caracas, Venezuela.
Schwab, Keith Ogden, Kansas City, Mo.
Shelfer, Thomas Basil, Shreveport, La.
Waring, Frederick Ernest, Darlington, N.S.W., Australia.

Univ. of Alabama
Ayres, William Arthur
Bebber, Howard Jones, Jr.
Brown, James Ray, Jr.
Grammer, Perry Lee
Harris, Joseph Edward
Kelley, Lester Hall

Alabama Pol. Inst.
Andress, Daniel Robbins, Jr.

Univ. of Arkansas
Howard, Robert Burham, Jr.

Brown Univ.
Warwick, John David

Univ. of California
Bestwick, Leroy Keith
Brown, Richard Lee
Humphrey, Glen Minor

Carnegie Inst. Tech.
Spray, Ronald Fisher

The Citadel
Ayres, William Howard
Mollory, James Bryan, Jr.

Colorado A. & M. Coll.
Harris, Richard Douglas
Kipper, Robert Sloan
McFarland, William Wiley
Speegle, Bruce Edward

Cornell Univ.
Powers, James Jerome, Jr.

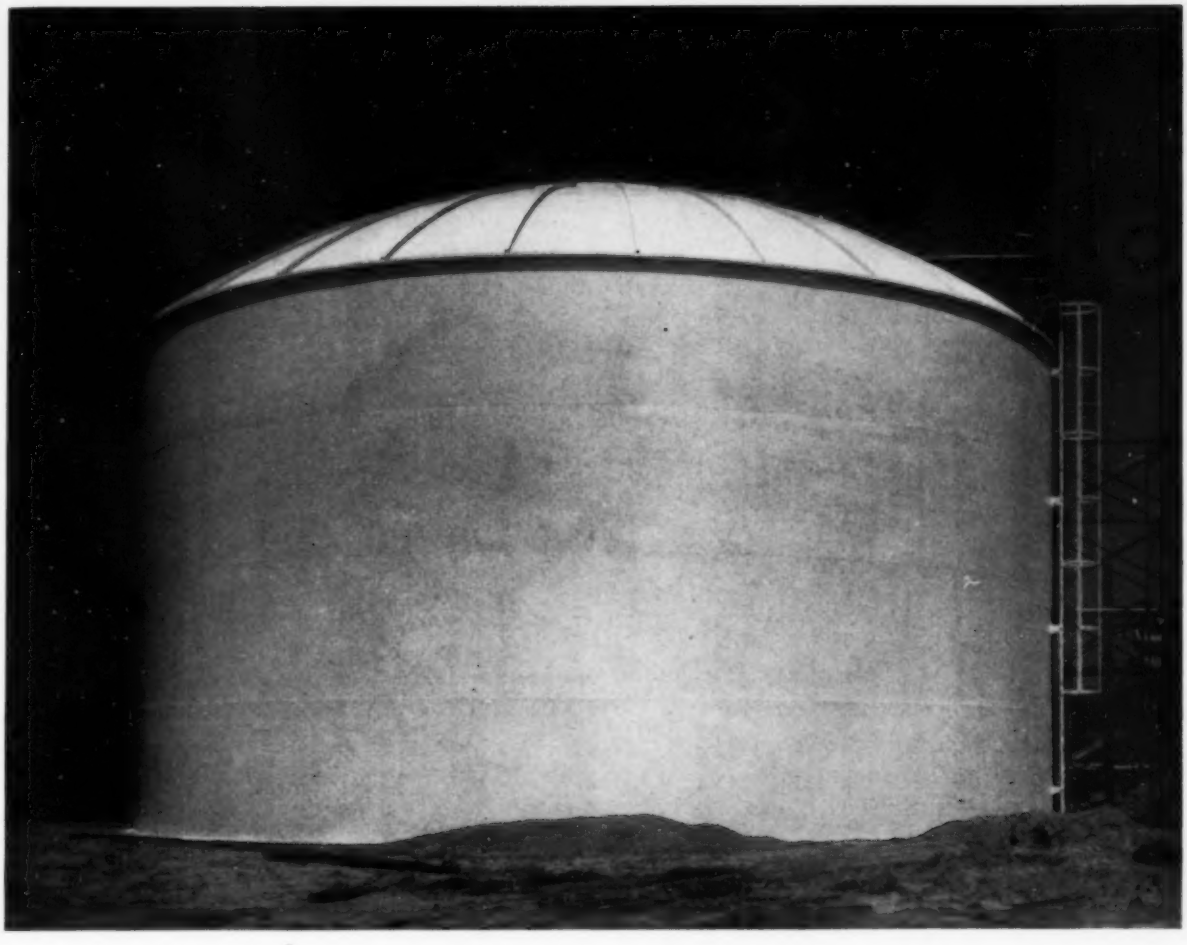
Univ. of Denver
Sujata, Henry Leo

Drexel Inst. Tech.
Zamecnik, Frank Jerry

Fenn Coll.
Gordon, Stanley

Univ. of Florida
Edwards, Charles Douglas
Gilbert, Linus Russell, Jr.
Hyatt, Joe Harrison
Murphy, Walter Robert, Jr.

(Continued on page 80)



How Lion Oil Stores Ammonium Nitrate

The Chemical Division of the Lion Oil Company produces about 500 tons per day of ammonium nitrate solution at its plant at El Dorado, Arkansas. The solution is produced by mixing 57 per cent nitric acid and ammonia gas in a neutralizer. Water is added to keep the concentration of the ammonium nitrate at 83 per cent.

The ammonium nitrate solution is transferred from the neutralizer to the 15,000-bbl. tank shown above through alloy pipe lines. All shell and bottom plates in this tank have a $^{1}/_{16}$ in. stainless steel cladding to prevent metallic contamination of the solution during storage. About 380 tons per day of dry, pelleted ammonium nitrate fertilizer is made from the solution stored in the tank.

Stainless-clad steel is one of several corrosion-resistant materials we used to build tanks and other chemical plant equipment. The others are listed at the right. We also build carbon steel plate structures such as flat-bottom tanks, spherical and spheroidal pressure storage tanks, cylindrical pressure vessels and elevated water tanks. Our shops have the necessary facilities and experience for fabricating process equipment to meet API or ASME codes or exacting customer specifications.

We are equipped to fabricate and erect storage tanks and process equipment from the corrosion-resistant metals listed at the right.

CLAD STEELS—Chrome-nickel or straight chrome stainless steels, monel or nickel.

LININGS—Chrome - nickel, straight chrome or ELC stainless steel, monel or nickel.

SOLID METALS—Chrome-nickel, straight chrome or ELC stainless steel, monel, aluminum or nickel.

You are invited to write our nearest office for information or quotations when you need structures made of carbon steel or corrosion-resistant metals.

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Atlanta 3.....2167 Healy Bldg.
Birmingham 1.....1596 N. Fiftieth St.
Boston 10.....1009—201 Devonshire St.
Chicago 4.....2199 McCormick Bldg.
Cleveland 15.....2263 Guildhall Bldg.
Detroit 26.....1541 Lafayette Bldg.
Houston 2....2128 National Standard Bldg.
Los Angeles 17..1556 General Petroleum Bldg.
New York 6.....3395—165 Broadway Bldg.
Philadelphia 3..1652—1700 Walnut St. Bldg.
Salt Lake City 4...509 West 17th South St.
San Francisco 4.....1584—200 Bush St.
Seattle 1.....1309 Henry Bldg.
Tulsa 3.....1647 Hunt Bldg.
Washington 6.....1647 Cafritz Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

ASCE Applications

(*Continued from page 78*)

Sutton, Charles Andrew, Jr.
Williams, Edwin Gex, Jr.

GEORGIA INST. TECH.

Mazanti, Billy Bruce
Parker, Lewis Emmett

UNIV. OF HAWAII

Masumoto, Noriyoshi

UNIV. OF ILLINOIS

Anderson, Roger Duane
Bisch, Robert Charles
Blachman, Martin Morris
Blasius, Robert Herman
Bloomquist, Yngve Sigvard
Boulding, Ernest Arthur, Jr.
Boyle, Austin Joseph
Bradfisch, Donald Eugene
Carlsson, Lawrence Algot
Clark, Graydon, Jr.
Cochran, Benny Lee
Corey, LeRoy Richard
Davis, Melvin Harry
Drake, Paul Glenn
Faust, Albert Dale
Felton, Dean Russell
Finley, Jack Eugene
Fritz, Lawrence Joseph
Fry, Thomas Samuel
Furtak, Charles Alexander, Jr.
Gang, James Earl
Gillespie, William Patrick
Graham, Joseph Gund
Gross, Walter Aloysius, Jr.
Grote, George Paul
Grotenhuis, Eugene Norman
Hahn, Elmer Michael
Heinen, John Arnold
Herlocker, Harwood Oxley, Jr.
Hernandez, Edmund Pena
Hofstetter, Harold Elwin
Hutchinson, John Wendle
Hybert, Robert Russell
Jacobs, Harold Anthony
Jessen, John David
Karpinski, Henry Joseph
Lake, Thomas David
Lillie, Harlan Maurice
Loescher, Richard Albert
Madura, Walter Paul, Jr.
Marlatt, William Keith
Martin, Mulford, Jr.
Moore, Ernest Otto, Jr.
Morrisett, Ralph Norman
Noda, Jim Masaki
Pannone, Frank Edward
Pistrui, William Martin
Poole, Warren Everett
Punyagupta, Somporn
Reuscher, Junior William
Rosenbery, Vernon Claire
Samartano, James Anthony
Shelp, Robert Harold
Sigfusson, Benedict
Smiley, James E.
Streed, Edward Alexander Christian
Sutherland, Ralph Dee
Tavares, James Francis
Thompson, Charles Lester
Von Huben, Harry Richard
Walker, Wilbur Lee
Wei, Benjamin Chih-Fang
Welter, George William
Winterroth, John Robert
Zarbock, Roy Frederick
Zedialis, Alex Edward
Zervas, James Edward

IOWA STATE COLL.

Blum, Richard Dale
Burk, John Warren
Kothe, Herbert Holmes

STATE UNIV. OF IOWA

Holle, Robert Carroll
Khanna, Gopi Nath
Nahmmacher, Carl Alfred, Jr.
Neuspiel, Peter Joseph
Perez, Jose Nieves, Jr.
Saemisch, Frederick Charles
Yanes, Adolfo

KANSAS STATE COLL.

Doty, Leslie Jewell
Faulconer, Hal Marvin
Ferguson, Elvin Gailey
Hanson, Earl Sidney

Heckathorn, Clifford Wynne
Huntington, Robert Charles
Hus, Richard Dewey
Knight, William Ernest
Moore, Edwin Richard
Mullins, Dean Dale
Steinbacher, Raymond Henry

UNIV. OF KANSAS

Buckland, Theodore Edward
Burris, Charles Richard
Debold, John Francis
Grant, Jack Talbott
Jefferies, Norman Clark
Jones, Byron Eugene
Leonard, Chester LeRoy
Stoutimore, Ralph Ross
Trull, Donald Emery

UNIV. OF KENTUCKY

Bently, Charles Alvin
Cable, Merle
Markham, Robert Allen
Maxey, Gatch Nelson, Jr.

LEHIGH UNIV.

Cesare, Arthur Victor

LOUISIANA STATE COLL.

Kleinpeter, Henry Eugene, Jr.

UNIV. OF MAINE

Welch, Vinal John

UNIV. OF MARYLAND

Brucksch, Richard, Jr.
Handler, Richard
Lawler, Norman Melbourne, Jr.
McKinney, William Butler
Schaefer, Edward Wilson

UNIV. OF MASSACHUSETTS

Gannon, William Bartlett
Murphy, Francis Joseph

MASSACHUSETTS INST. TECH.

Long, Carl Ferdinand
Schupak, Irving Israel

MICHIGAN STATE COLL.

Siefert, William Herman

UNIV. OF MINNESOTA

Hodgins, Robert Irven, Jr.
Lundstrom, Roland Edward
Olson, Kenneth Oscar

MISSISSIPPI STATE COLL.

Bennett, Claude, Herbert
Bethea, George Harvey
Cook, Lester Green, Jr.
Crow, Joe McClain, Jr.
Davis, Herman Keith
Fisher, Baxter James, Jr.
Johnson, James Sylvanus
McDearman, Bernard Egbert, Jr.
Roberts, Lawrence Morgan

UNIV. OF MISSOURI

Adams, Darrell Eugene
Coon, Lowell Leslie
Crane, Franklin Pierce
Dunham, Charles Palmer
Fesler, George Junior
Gentry, Claude
Gilmore, Robert Dale
Gustler, Harold Lee
Marchese, Charles Jerry
McIntire, Kenneth Burton
Murry, Robert William
Nilson, Robert Earl
Olson, John Edwin, Jr.
Pepple, Robert Lee
Picone, Alexander
Rader, Harold Pearce
Redman, Donald Lee
Saller, Aloysius Joseph
Strickland, Rogers N.
Waller, John Pollard

MISSOURI SCHOOL OF MINES

Ballestero, Antonio Prada, Jr.
Burkhardt, Billy Lee
Clark, John William, Jr.
Clark, Howard Thurman
Cotten, Merrill Roald

(*Continued on page 83*)

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

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This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Now Is the Time to Make Your Availability Known to Your Personnel Service!

Our registrations of men available are at an all-time low. Many fine executive and engineering opportunities are available for which the Service does not have the personnel to recommend. Therefore, if you are unemployed or seeking a better opportunity, contact the nearest office of the Engineering Societies Personnel Service, Inc., New York, Chicago, Detroit, or San Francisco.

The opportunity you have been waiting for may be waiting for you now!—Alfred H. Meyer, Executive Director.

Men Available

CIVIL AND SANITARY ENGINEER; Assoc. M. ASCE; 40; married; 2 children; registered civil and registered chemical engineer in California; registered civil engineer in Illinois; degrees, B.A. in chemistry, B.S. and C.E. in civil and sanitary engineering; 15 years' experience in design, construction, and operation of sewage and water-treatment plants. Available in 30 days. Prefers West Coast. C-659.

CIVIL ENGINEER; Jun. M. ASCE; B.S.C.E., University of California, 1942; postgraduate, University of Michigan, 1944; 32; married; 2 years' structural design; 3 years' engineering administration; engaged in report writing, estimates, and supervision of field surveys and construction inspectors. Speaks Spanish. Prefers Mexico or South America. C-660-512-A-11-San Francisco.

CIVIL ENGINEER; Assoc. M. ASCE; holds engineering degrees from Argentina and United States universities, latter from University of Illinois; perfect Spanish, good knowledge of other Latin languages; 10 years' experience in concrete structures and soil mechanics; desires position in Latin America, preferably with American concern. C-661.

CIVIL ENGINEER; Jun. M. ASCE; civil graduate; 28; single; veteran not subject to recall; 2 years' experience in design and field experience in subdivision layout, sanitary and storm sewers, water distribution and streets, highway relocation; 2 years' experience as topographic computer and surveyor; 6 months as housing construction overseer. C-662.

CIVIL ENGINEER; Assoc. M. ASCE; registered professional engineer; age 47; 24 years' varied experience including design, layout and supervision of construction, building projects, sewerage systems, sewage-disposal systems, subdivisions, and streets and highways. Army experience on administration of large projects and cost plus fixed-fee contracts. Desires position with construction firm on a salary-bonus basis. C-663.

CIVIL ENGINEER; Assoc. M. ASCE; registered in New Jersey; over 25 years' experience estimating, subcontracting, purchasing and complete office routine. In the field as inspector, layout engineer and general superintendent on all types of buildings, state roads, culverts, bridges, and city streets. Also general concrete and steel structures. Desires position within 250 miles of New York, N.Y. C-664.

Positions Available

ENGINEERS. (*a*) Assistant to construction manager, young, civil graduate, with 5 years' office and field experience in concrete construction, to coordinate field construction, check contracts, write requisitions, etc. Some travel. Salary, $5,200–$6,500 a year. (*b*) Civil Engineer, graduate, over 28, with carpentry, concrete mixing, and general heavy construction experience for work with construction crews on concrete-storage facilities. Considerable traveling in South and West. Salary, $4,160–$4,680 a year. Headquarters, New York, N.Y. Y-4901.

CONSTRUCTION ENGINEER, preferably under 35, for company engaged in the construction of industrial buildings. Will be responsible for central office control of all engineering projects. Civil engineering degree with experience in good construction company. Salary, about $10,000 plus bonus. Location, Midwest. Y-4910.

FINANCIAL MANAGER for large general contractor. Accounting knowledge necessary. Must have construction experience. Location, Michigan. Y-5019.

CIVIL ENGINEER. Must be registered. Municipal experience desirable. Salary to start $4,000–$5,300 a year, depending upon experience. Location, Ohio. Y-5024.

INSTRUCTOR, civil graduate, preferably with M.S. in structural engineering, to teach undergraduate courses in civil engineering. Salary, $3,000–$3,700 a year. Location, New York metropolitan area. Y-5028.

CIVIL ENGINEER, graduate, 35–50, thoroughly experienced in bridge and grade-separation work, road and railroad facilities, industrial buildings, sewage and water treatment plants, and sewer, water, and drainage facilities. Experience in the preparation of plans, specifications, and contract documents. Will supervise several engineers and draftsmen, do some design, specification, and report work, but most important, should be able to supervise effectively subordinate personnel, obtaining efficient productivity and desirable personnel conditions. Salary, $6,600–$7,500 a year. Location, Louisiana. Y-5062.

STRUCTURAL, CIVIL, OR MECHANICAL ENGINEERS, preferably graduates, with 10 years, minimum office experience in designing and preparing working drawings of reinforced concrete and steel-framed industrial buildings and structures. Experience in preparation of cost estimates and construction specifications for industrial buildings and process equipment installation desirable. Will do general planning of building additions, changes and major repairs for industrial plants. Prepare complete working drawings of industrial buildings and structures of reinforced concrete steel frame or frame construction. General planning and preparation of working drawings of process equipment installations. Preparation of cost estimates and construction specifications. Field supervision and inspection of building construction and equipment installation. Location, Washington State. Y-5078.

STRUCTURAL STEEL DESIGNER with experience covering mill buildings and processing plants wanted by leading structural steel fabricating company. Salary, $6,000 a year. Location, Missouri. Y-5093.

CIVIL ENGINEERS. (*a*) Civil Engineer, graduate, with experience in waterworks construction for $500,000 project. After completion of project will supervise operation of plant. Must have some experience in hydraulic design. Permanent. Salary open. Location, upstate New York. (*b*) Civil Engineer, recent graduate, for work in construction, engineering, and installation on a water utility. Some hydraulic design experience desirable. Salary open. Location, Long Island, N.Y. Y-5096.

PROJECT ENGINEER, 35–55, civil graduate preferred, but chemical or mechanical graduates considered who have had experience in design and construction of chemical buildings. Must have at least 5 to 10 years' experience in the supervision of construction, including industrial or chemical plants, and preferably also office buildings and similar projects. Prefer 2 years' experience on design or related engineering work in the office in connection with industrial or chemical plants, and at least 2 years in a responsible management position. Salary, $7,500–$9,000 a year. Location, upstate New York. Y-5107.

ENGINEERS. (*a*) Resident Engineers, 28–45, for the supervision of building construction. Civil or building construction degree preferred, with at least 2 years' or more experience in the supervision of construction, including specific experience in the building construction field, and preferably at least 1 year's experience in design or other similar engineering activities in the office. (*b*) Resident Engineer, 30–45, for the supervision of chemical plant construction, with chemical, civil, or mechanical degree, and at least 4 years' experience in the supervision of construction, including at least 2 years' on chemical plant work, and at least 1 year's experience in design work in the office, for chemical engineering projects. Salaries, $5,000–$7,300 a year. Location, upstate New York. Y-5108.

ENGINEERS experienced in design on water and sewage treatment projects for consulting office. Location, Ohio. Y-5110.

Positions Available

SANITARY ENGINEER with experience in the design of water supply, sewage, drainage, etc. Permanent. Salary, $4,200–$7,800 a year, depending on experience. Headquarters, New York, N.Y., with occasional field trips of from 30 to 90 days. Y-5134.

JUNIOR ASSISTANT ENGINEERS to design or supervise the construction of sewers, or to act as inspectors on the construction of sewers and sewerage works. Location, Connecticut. Y-5142.

STRUCTURAL ENGINEERS. (a) Senior civil, over 30, with considerable experience at substantial levels with design in industrial buildings in general engineering department for an essential packing plant company. Require unusual and high grade engineers. Salary commensurate with experience. (b) Junior engineer qualified to deal with elements of design of industrial buildings in general engineering department for an essential packing plant. Salary commensurate with experience. Location, Chicago, Ill. R-7530.

ASCE Applications

(Continued from page 81)

Crowell, Gilbert Leroy
Dalton, Thomas Joseph, Jr.
Knepper, Andrew Edgar
Lillibridge, Robin
Llewellyn, Henry Dearing
Moy, Harry
Parrish, David Duane
Ross, Leroy Ellsworth, Jr.
Wees, Francis Edward, Jr.
Zane, Robert Irvin

UNIV. OF NEBRASKA

Bonneau, Leo Francis
Bowerman, Fay Lester
Brehm, Harold Eugene
Buresh, Raymond Charles
Christensen, Richard Anton
Claussen, Gene Arthur
Cuckler, Raymond Eugene
Dederman, Arthur Harold
Ericson, Donald Wesley
Gruhn, Lloyd Otto
Hay, Gaylord Wayne
Heineman, Edward, Jr.
Hohnstein, Elmer LeRoy
Hollman, Edgar Adams
Hosmack, James Quimby
Howard, Roswell Bill
Hunt, Wilmer Amos
Miyamoto, Alvah Tsuyoshi
Olson, Donald Lee

COLL. CITY OF NEW YORK

Dicker, Daniel
Binhorn, Louis
Levy, Matthys Paul Benjamin
Schneider, Seymour
Walter, Lothar John

UNIV. OF NORTH DAKOTA

Gray, Wayne Arthur

OHIO STATE UNIV.

Henderson, Richard Harold

OKLAHOMA A. &. M. COLL.

Durbin, Roy
Lieber, James Howard

UNIV. OF PENNSYLVANIA

Shaibley, Kenneth William

PENNSYLVANIA STATE COLL.

Mebus, Charles Fillmore 2nd

UNIV. OF PITTSBURGH

Alexander, Walter Dean
Apel, Robert Virden
Bailey, Victor James
Ference, Edward William
Hammond, James Rolland
Hawthorne, William Andrew, Jr.
Kawala, Edward Leon
Klinzing, Jack Marvin
Trunick, Robert Paul

UNIV. OF PUERTO RICO

Villarini Viader, Jorge Antonio

(Continued on page 84)

Have You Changed Your Address?

If a change in your most recent address—residence or business—has not been furnished to ASCE Headquarters, the Society is unable to serve you completely. Your publications go astray; your ballots do not arrive; and your correspondence is returned. To eliminate these problems, fill out the form below completely, paste on a postcard, and address it to the Executive Secretary, American Society of Civil Engineers, 33 West 39th Street, New York 18, N.Y.

ASCE MAIL AND BUSINESS ADDRESS RECORD

Name ..... (Last Name) (Please Print) (First Name) (Middle Name)

Title or Position .....

Please Print or Type All Information

Name of Firm or Organization .....

Business Address ..... (Street) (City) (State)

Residence Address ..... (Street) (City) (State)

Send Mail and Publications to: Business Address ☐ Residence Address ☐

Nature of Firm's Business .....

Product, Business or Service (Not for Publication)

Signature .....

ASCE Applications

(Continued from page 83)

PURDUE UNIV.

Anderson, Allen Edward
Bazo, Alfred
Beck, Arthur Frederick
Branson, Charles Eugene
Cicillian, John Edward
Dalton, Frank Edward
Eizenhoefer, Claude Eugene
Farr, James Russell
Goff, Joe Sargent
Harman, Jacob Anthony
Hong, Franklin Leong
Johanningsmeier, Paul William
Katche, Leslie
Ketola, Rudolph
Klingler, Ray Ernest
Knauss, Ralph Albert
Lyons, Gerald Stephen
Mathys, Robert Wayne
Mayfield, Joe Asbury
McMullen, William Edgar
Mindrup, Francis Joseph
Miskus, Walter William
Myers, Seymour
Ottenweller, Maurice Franklin
Piscotta, Paul James
Ratner, Paul
Rice, Thurman Brooks, Jr.
Schaeffer, Robert Ollie
Schoppenhorst, Charles Emerson
Secrest, Lewis Ramon
Swing, Donald Owen
Ulbrich, Donald Ray
Vana, Edward Merle
Vollmer, Arnold Lee
Warner, Glenn Duane
Wood, Frank Henry
Zelenka, Robert Anthony

RENSSELAER POL. INST.

Cavanagh, Warren Brennan
Ennis, Wesley Dale
Lilue, Albert George

UNIV. OF SANTA CLARA

Otis, Robert James

SOUTHERN METHODIST UNIV.

Harper, Wesley Lloyd

STANFORD UNIV.

Lockwood, Albert Bruce

SYRACUSE UNIV.

Bornhurst, Jerome Patrick
Nostrand, William Alfred, Jr.

UNIV. OF TENNESSEE

Boring, Kenneth Edwin
Flynt, Jackson Kenneth
Hixson, Roger Swingle
Nathan, Robert Lindsay

UNIV. OF TEXAS

Turner, Gerald Lynn
Weller, Oree Cunningham

TEXAS TECH. COLL.

Boren, Robert James
Egger, R. B.
Egger, Royce Charles
Gordon, Clifford Cole
Harvey, John Carothers
Hutchins, Edward Jones, Jr.
Jackson, Hugh L., Jr.
Lewis, Joe Riley
Link, Allan Lamar
Loftin, Delmar Darryl
Miller, Jack Wallace
Montgomery, Austin Homer, Jr.
Taylor, Albien Leon
Wells, Dan Moody

UNIV. OF TOLEDO

O'Heir, Richard John

UNION COLL.

Bertram, Albert Elmore

VILLANOVA COLL.

Di Cocco, Louis Rocco

WASHINGTON STATE COLL.

Bowlin, William Russell
Card, Bradley John
Hettinher, Keith Allison
Johanson, Dean Freburg
Pardew, William West
Rankin, James Albert
Satterthwaite, John Sharp
Sherwood, Glen Wallace
Skrinde, Rolf Thorsten

UNIV. OF WASHINGTON

Bishop, Garland Wayne
Bonner, Richard Ray
Chin, Ark Geow
Duggan, James Philip
Klute, Kenneth Aolo
Lamont, Joseph, Jr.
McCullough, Floyd Westman Jr.
Olson, Kenneth Frederick
Price, Arthur Idris
Therriault, George William

WAYNE UNIV.

Banicki, John, Jr.
Dossett, Robert Roy
McCamman, Ernest Rice
McCarty, James Campbell, Jr.

UNIV. OF WISCONSIN

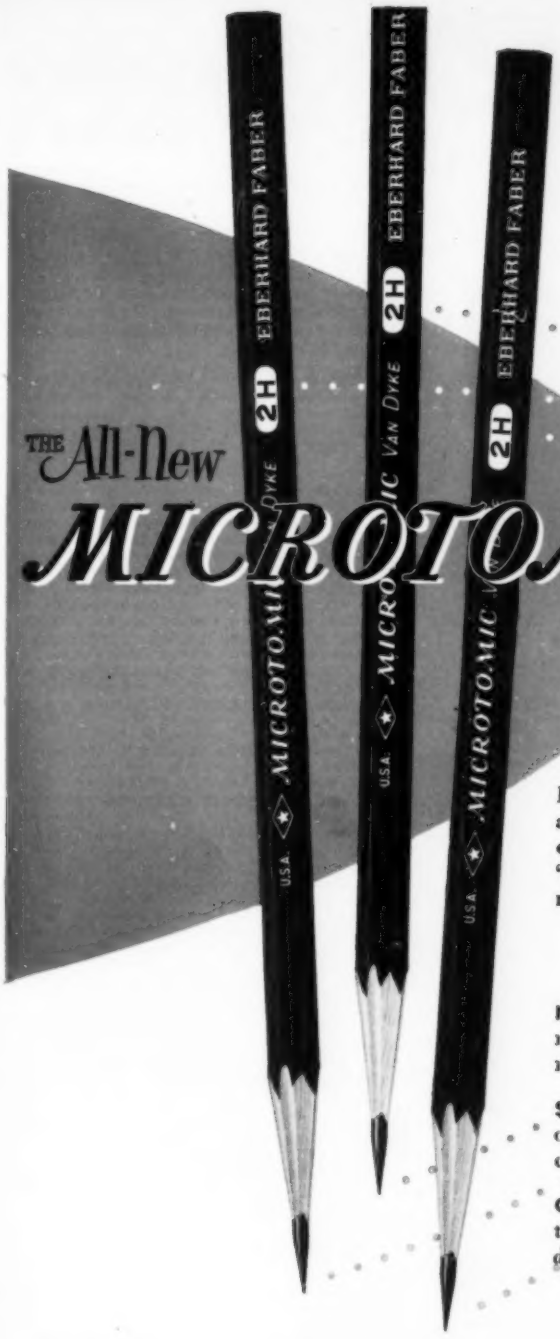
Edwards, John Charles
Gerschke, Franklin Richard
Gramoll, Robert Edward
Hansen, Richard George
Hering, Robert Junior
Jansky, Louis Joseph
Launders, Gordon Avery
Martiny, Myron Cole
Rasmussen, Walter Clark
Townsend, William Wadsworth

WORCESTER POL. INST.

Norton, Francis William

UNIV. OF WYOMING

Engleman, Ivan Merle
Howard, Clyde Alwyn
Riggins, Edward Everett
Sweeney, Thomas Joseph
Williams, Robert Edward



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RECENT BOOKS

Critical Requirements for Research Personnel, March 1949, 66 pages; **Development of a Test for Selecting Research Personnel,** January 1950, 33 pages; **Procedures for Evaluating Research Personnel with Performance Record of Critical Incidents,** June 1950, 42 pages.

These three reports describe part of a long-range program concerned with research in the effective utilization of scientific personnel. Available upon application to the American Institute for Research, Pittsburgh, Pa.

Elasticity

A selection of recent developments in mathematical theory and applications of elasticity and plasticity are covered in this symposium of 17 papers, which constitutes Volume III of the Proceedings of Symposia in Applied Mathematics of the American Mathematical Society, co-sponsored by the Applied Mechanics Division of the American Society of Mechanical Engineers. Topics such as extensions of approximation methods and the general theory of elastic and plastic deformation are thoroughly covered, as well as new applications of the elastic theory of structural members and new methods of stress analysis in elastic and elastic-plastic structures. McGraw-Hill Book Co., New York, Toronto, London, 1950. 233 pages, $6.

Elementary Theory of Structures

Primarily intended for civil, mechanical and electrical engineering students, *Elementary Theory of Structures*, by J. C. Grassie, covers the fundamental principles of mechanics as applied to the theory of structures. Its scope is confined entirely to determinate structures. Following chapters dealing with the action of dead loads on structural members, solid structures and framed structures, the action of live loads systems is discussed. Graphical aspects of solutions are stressed and examples with answers are included. Longmans, Green and Co., London, New York, Toronto, 1950. 392 pages, $5.

Engineering Profession by T. J. Hoover and J. C. L. Fish. 2 ed. Stanford University Press, Stanford, Calif.; Geoffrey Cumberlege, Oxford University Press, London, 1950. 486 pages, $7.50.
Engineering Method by J. C. L. Fish. Stanford University Press, Stanford, Calif., 1950. 186 pages, $3.

Serving both as a vocational guide and an analysis of the profession, *Engineering Profession* describes the qualifications and duties of the professional engineer and his habit of mind. Following the discussion of who is an engineer, what is engineering, and the general scope of engineering, the next five chapters discuss specific types of engineering. The method of engineering is considered next, and then three chapters deal with vocational guidance, education, and the contribution of engineers to mankind. Chapters 9, 10 and 11 have been organized in a separate volume entitled *The Engineering Method*.

Flow Measurement with Orifice Meters

Intended mainly for the use of engineering, technical service, and instrument groups concerned with process control, test work, and plant start-ups in the petroleum industry, *Flow Measurement with Orifice Meters* by R. F. Stearns, R. M. Jackson, R. R. Johnson, and C. A. Larson, provides information required for the effective use of fixed-area orifice meters in common refinery applications. The procedures outlined typify methods currently used in refinery operations, and the extensive physical data presented are limited for the most part to

fluids found in petroleum refining. D. Van Nostrand Co., Toronto, New York, London, 1951. 350 pages, $7.50.

National Conference on Industrial Hydraulics

Papers presented at the 1949 National Conference on Industrial Hydraulics are made available in Volume III of the Proceedings, October 26–27, 1949. Broadly classified, the papers deal with recent developments in the field, hydraulic components, pumps and turbines, technical design data, equipment standards, and applications and performances. Published by National Conference on Industrial Hydraulics, Armour Research Foundation of Illinois Institute of Technology, Chicago 16, Ill., 1950. 218 pages, $3.50.

Ordinary Non-Linear Differential Equations in Engineering and Physical Sciences

N. W. McLachlan, author of *Ordinary Non-Linear Differential Equations in Engineering and Physical Sciences*, shows how certain types of non-linear problems may be solved, and how experimental results may be interpreted by non-linear analysis. The book is chiefly confined to the presentation of various analytical methods employed in the solution of important technical problems. Oxford University Press, New York; Clarendon Press, Oxford, England, 1950. 201 pages, $4.25.

Meetings and Conferences

American Institute of Electrical Engineers. The Southern district meeting of the American Institute of Electrical Engineers will be held at the MacFadden-Deauville Hotel, Miami Beach, Fla., April 11–13.

American Wood-Preservers' Association. Development in wood preserving techniques will be discussed at the annual meeting of the American Wood-Preservers' Association at the Stevens Hotel, Chicago, Ill., April 24–26.

British Industries Fair. The annual British Industries Fair is scheduled for Birmingham, England, April 30–May 11.

Engineering Institute of Canada. Headquarters for the annual meeting of the Engineering Institute of Canada will be the Mount Royal Hotel, Montreal, Canada, May 9–11.

Florida Highway Conference. Discussions on the effects of the national emergency on the highway program will be presented during the fifth annual Florida Highway Conference at the University of Florida in Gainesville, May 14 and 15. The conference is being sponsored by the department of civil engineering in conjunction with the Engineering and Industrial Experiment Station.

Forest Products Research Society. The fifth national meeting and international industry show of the Forest Products Research Society will be held in Convention Hall, Philadelphia, Pa., during the week of May 7.

Illinois Structural Engineering Conference. Sponsored by the civil engineering department and the division of extension services at the University of Illinois, the Illinois Structural Engineering Conference will be held on the campus in Urbana, on April 17 and 18.

Ohio State Welding Conference. The twelfth annual Ohio State Welding Conference, under the sponsorship of the department of welding engineering at Ohio State University with several local chapters of the American Welding Society cooperating, will be held in the new welding laboratories on the campus in Columbus, April 13 and 14.

Society of Automotive Engineers, Inc. The Society of Automotive Engineers, Inc. will hold its aeronautics meeting and aircraft engineering display at the Statler Hotel, New York, N.Y., April 16–18.

Water and Sewage Works Manufacturers' Association, Inc. The Water and Sewage Works Manufacturers' Association, Inc. will hold its annual meeting in Miami, Fla., on May 2, during the 1951 American Water Works Association Convention.

CATALOG DIGESTS of ENGINEERING and INDUSTRIAL Interest

1 AERIAL MAPPING

Aero Service Corporation—offers catalogs or literature covering its varied aerial mapping services. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, airborne magnetometer surveys for ore and oil, and both plastic and plaster relief maps. Services discussed are used in highway design, plant engineering, industrial development, community planning, geological explorations and prospecting for oil or minerals.

2 AIR INLET VALVES

Simplex Valve & Meter Company—An essential booklet is Bulletin 125, for all engineers interested in pipeline construction and use. It describes fully and completely the theory and application of Air Inlet (vacuum breaking) valves and discusses why these should be installed on all thin-walled pipelines where vacuum conditions might cause pipe collapse.

3 ALLOYS

American Managanese Bronze Co.—A 50-page edition of the "Reference Book of Bronze Casting Alloys" gives general information regarding composition, characteristics, and application of many of the common or typical alloys. The book will help the engineer or designer in the selection of the right alloys for any general application.

4 ARC WELDING

Lincoln Electric Co.—A series of studies of modern welded structures and modern welded design fundamentals is offered. The current series details design and construction of a modern welded deck girder highway bridge, 5 spans, 480 ft long. Buildings and building details such as rigid framing are covered in the recent studies. Free to engineers, architects and builders.

5 BALL & ROLLER BEARINGS

Link-Belt Co.—The 112-page Data Book No. 2550 illustrates, tabulates and describes the full line of ball and roller bearings. It contains pages of valuable engineering information on how to select the proper bearing for a specific service, with diagrams and photographs of typical applications.

6 BLUEPRINT MARKING PENCIL

American Lead Pencil Co.—New brilliant colors in the Venus color pencil line for marking on blue or white prints. 54% stronger—sharpens to a sharp needle point and holds it. 27% greater markability—brilliant clear marking—waterproof, too!

7 BORINGS

Raymond Concrete Pile Co.—A booklet "Subsoil Investigations for Foundations" catalog B-2 explains the reason for subsoil investigations, what Gow borings are and how they are made, and results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

8 BUILDINGS

Timber Structures, Inc.—"Industrial Buildings," an 8-page catalog, illustrates applications of engineered timber construction in the field of industrial plant buildings, with special reference to glued laminated members and their qualifications for heavy timber or mill type construction. Units shown include arches, girders, beams and bowstring and parallel chord trusses. Drawings show adaptations of arches, girders and trusses, while tabulated tables give important data of span, height, weights and bearing details.

9 BUSINESS & TECHNICAL GUIDE

McGraw-Hill Book Co.—Here is a guide to practical, expert information on many business and technical subjects. The catalog contains clear, concise descriptions of more than 2,000 books written by leaders of business, industry and research. In it there is an up-to-date listing of books that give the facts—experience—data—needed in solving your particular problems.

10 CAST IRON PIPE

Cast Iron Pipe Research Assoc.—A brochure, revised in 1950, gives general specifications, weights and dimensions of standardized mechanical joint cast iron pipe, fittings and accessories for water and gas. Tables show weights and dimensions for pipe centrifugally cast in metal and sand-lined molds and pitcast pipe.

11 CHEM-O-FEEDERS

%Proportioneers, Inc.%—Bulletin describes application of chem-o-feeders for chlorine dioxide, hypochlorite, and chemical feeding to municipal and private water supplies, sewerage treatment, and swimming pools. Exclusive "See-Thru" reagent heads permitting visible inspection of all moving parts in contact with chemical solution, corrosion resistance, and ability to operate under high pressure are some of the advantages discussed.

12 CONCRETE AIRPORT PAVEMENT

Portland Cement Assoc.—The 46-page booklet is a manual of new design procedures for runways, aprons and taxiways made necessary by heavier wheel loads and multiple wheel landing gears. It contains simplified design charts for determining slab thickness under different conditions of service, jointing practices, use of reinforcing steel, subgrade preparation and construction procedures for concrete resurfacing.

13 CONCRETE FORMS

Irvington Form & Tank Corp.—The 40-page manual describes the simple and fast method of erecting and dismantling Atlas speed forms. It contains a number of drawings and photographs illustrating various methods of using the speed forms on all types of concrete structures such as; circular tanks, commercial buildings, dams, bridges, slabs, housing, etc.

14 CONCRETE FORM-TIES

Richmond Screw Anchor Co., Inc.—Comprised of 8 sections devoted to the various styles, types and sizes of form-tying devices and other accessories for concrete construction, the new catalog is an extremely informative, fact-packed manual which shows by charts, pictures and word descriptions the proper selection and use of each of the items in the Richmond line. Also, the section on screed supports has been revised and brought up to date as of October 1950. The catalog covers snap-tys, tyscrus, hanging systems, screw anchors and bolts, inserts and other devices.

15 CONCRETE PIPE

Lock Joint Pipe Co.—A pamphlet describes all past installations of Lock Joint pressure pipe and is illustrated with cross-section cuts of joints and pipe design. Another illustrated pamphlet describes the manufacture and technical design of prestressed concrete cylinder pipe.

16 CONCRETE PIPE FOR IRRIGATION AND DRAINAGE

American Concrete Pipe Association—An official publication has just been released and is available to engineers. Contains information on design of irrigation pipe lines, construction of irrigation pipelines, methods of irrigating with concrete pipelines and descriptions of various irrigation projects. This book is priced at 70¢.

N. B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.

17 CONCRETE SAWS

Clipper Mfg. Co.—has illustrated information on a complete line of 1½ to 13 hp gasoline and electric powered portable concrete saws in Circular No. 1-C. They offer the answer to concrete cutting of all kinds; patches, utility trenches, contraction joints, drives, walks, and even curbs and large concrete pipe.

There are 172 Digest items on pages numbered 88 to 106. Read all items for the literature of interest to you. It is requested that students and educators write direct to manufacturers.

Mail This COUPON To-day

CIVIL ENGINEERING Date.....
33 West 39th St., New York 18, N. Y.

Please have the literature indicated by the circled Catalog Digest numbers in the April 1951 issue sent to me without obligation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16*	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60*
61	62*	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79*	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144	145*	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
166	167	168	169	170	171, 172									

* There are charges for items Nos. 16, 60, 62, 79, and 145. See Notes below these items.

To receive Literature—Firm Name and your Position must be given.

Name..... ☐ Am. Soc. C.E. Member ☐ Non-Member

Position.....

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City and State.....

NOT GOOD AFTER May 15, 1951, for readers in the U.S., but requests will be accepted to June 30, 1951, from readers outside of this country.

Use This Free Service—Mail The Coupon To-day

Maintains roads and streets. Slopes banks. Cuts ditches. Grades shoulders. Levels subdivisions. Finishes between forms. Works and spreads oil mix. Strips sod. Handles terracing.

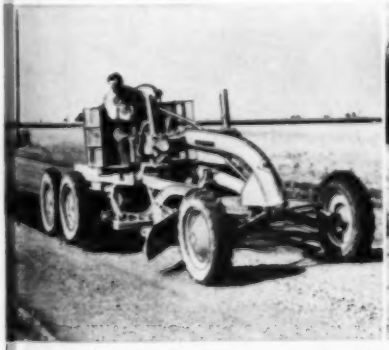
Loads sand, gravel, snow, other bulk material . . . surplus dirt from roads and streets. Rear-mounted, ⅝ cu. yd. bucket, hydraulically controlled.

only the model D can handle so great a variety of jobs—at a new low cost

WEIGHT — 8,500 lb. (bare)
BRAKE HP. — 34.7 (famous Allis-Chalmers gasoline engine)
SPEEDS — four forward, to 18.6 mph.; reverse to 2.9

More than a highly efficient, low-cost motor grader with big grader features . . . the "D" is an all-year, many job machine . . . the most useful grader on the market today with easily mounted, matched attachments.

Let your ALLIS-CHALMERS dealer show you what the Model D can do for you!



Scarifies toughest surfaces. Mounting behind blade makes full use of weight and traction . . . steering is positive, easier.

Plows snow. Interchangeable V or blade-type plows, hydraulically controlled. Blade plow also backfills, handles light 'dozing.

Hydraulically controlled WINDROW ELIMINATOR feathers out windrow left by grader blade — saves extra passes.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

FOR GREATER PRODUCTION...FOR EASIER OPERATION...FOR SIMPLIFIED SERVICING

18 CONCRETE STEEL-CYLINDER PIPE

Price Brothers Co.—has a pamphlet, illustrated with photographs and diagrams, on prestressed concrete steel-cylinder pipe for high pressure water supply lines. It tells: how it is manufactured; how steel and concrete are combined to form an elastic structure through prestressing; and how the steel and rubber joint provides a flexible, watertight connection.

19 CONDENSER CIRCULATORS

Economy Pumps, Inc.—Vertical, mixed-flow pumps for condenser circulation are the subject of a new catalog, No. G-1050. Illustrated and described are standard sizes from 1000 gpm to 100,000 gpm, and specials up to 200,000 gpm.

20 CONTROLLERS AND LAYOUTS

Simplex Valve & Meter Company—Bulletin 250 gives dimensional data on horizontal and vertical type controllers and clearance layouts for these units when using different type close-off arrangements. Type "S" rate controller for use in effluent lines from rapid sand type filters. This bulletin is of essential interest to the filter plant designing engineer.

Prompt return of your coupon will bring your literature to you sooner.

21 COPYING MACHINE

Charles Bruning Company, Inc.—Development of an entirely new type of office copying machine is announced in an 8-page bulletin. The machine, named BX Copyflex, is the first specifically designed to make low-cost direct positive copies anywhere in a business office. It is the answer to the need of modern business for a quick, clean method of privately making low-cost, error proof copies any where in an office.

22 CORE DRILLING MACHINE

Sprague & Henwood, Inc.—Bulletin No. 185 describes in detail Model 40-C, a core drilling machine. The outstanding construction features of this new unit are clearly presented and ample pictures enable the reader to understand better the combinations of power units and swivelheads that are available.

23 CORE DRILLING MACHINES

Sprague & Henwood, Inc.—Bulletin No. 305 describes four of the more popular models of core drilling machines. This publication furnishes a brief description of the various machines and emphasizes the outstanding features of each. Capacities are shown for each drill when using the various sizes of standard diamond drill accessories available.

24 CRANE-EXCAVATORS

Wayne Crane Div., American Steel Dredge Co., Inc.—A 14-page catalog, illustrating in color the heavy-duty line of Wayne Crane $\frac{1}{2}$-yd crane-excavators, has been published. Numerous "money-making" features of all three models—crawler, truck and wagon—are shown in this descriptive catalog. These include the deck machinery layout, self-leveling chassis, oversize 20 in. clutches, large modern cab and right angle drive mechanism. Complete specifications and operating data are also included in the catalog.

25 CRAWLER TRACTOR

International Harvester Co.—An 8-page mailing folder, A-614-NN, describes the features of the International TD-6 diesel crawler tractor. Produced in two colors, the folder has pictures, sectional views, and diagrams describing the 31.3 drawbar horsepower TD-6 diesel crawler.

26 CRAWLER TRACTOR

International Harvester Co.—An 8-page, 2-color mailing folder, A-351-NN, describes the International TD-9, increased horsepower diesel crawler tractor. The folder has pictures, sectional views and specifications on the 40$\frac{1}{2}$ drawbar horsepower crawler.

27 CRAWLER TRACTORS

Allis-Chalmers Mfg. Co.—Two attractive 16-page catalogs—each telling the story of a crawler tractor—have just been issued. One describes the Model HD-9, the other covers the Model HD-15. Each catalog utilizes double-page spreads to discuss major features of the tractors. Both make extensive use of large illustrations of the two units and their components. Captions give tractor buyers the information they want quickly and concisely. Complete specifications, plus details of allied equipment and special accessories are also included.

28 CRAWLER TRACTORS AND PIPEBOOMS

International Harvester Co.—A colorful 12-page crawler tractor-pipeboom combination catalog featuring International crawler tractors and Superior pipebooms is now available. This catalog contains pictures, specifications, and charts explaining the features of these tractors and pipebooms.

29 CRUSHING AND SCREENING PLANTS

Austin-Western Company—Bulletin No. 1900 describes the latest Austin-Western two-unit and three-unit portable crushing and screening plants which have been developed for either pit or quarry use. How these plants are capable of delivering high tonnages of aggregate in accurately controlled sizes; and how the three units (primary breaker, primary and secondary) may be used separately or in combination, as desired, providing flexibility of operation, is contained in the bulletin.

Please do not waste material. Ask only for what you can use.

CATALOG DIGESTS

30 DIAMOND AND SHOT CORE DRILLS

Acker Drill Company, Inc.—Bulletin No. 33 describes a complete line of lightweight portable core drills and soil sampling equipment. It also describes both diamond and shot type drill rigs, their uses and applications.

31 DIATOMITE FILTER

Permutit Co.—Bulletin 3415 describes the operation and advantages of the diatomite filter which requires less space, saves cost of coagulants and saves in amount of backwash water. The improved type of filter element is completely rigid, resistant to corrosion and lacks wires or screens which may be easily damaged or clogged.

32 DRAFTING SUPPLIES

Berger Scientific Supplies, Inc.—will furnish upon request its well illustrated catalog describing a complete line of drawing instruments, slide rules, T squares, curves, triangles, scales and other equipment for architects, engineers and draftsmen.

33 DRAINAGE STRUCTURES

Armco Drainage & Metal Products, Inc.—A 6-page folder, "An Economical Answer to Limited Headroom—Fast Runoff," describes the water-carrying capacity, strength and durability of Armco pipe-arch and multi-plate pipe-arch. Test data and case histories show that the drainage structures have more than sufficient strength for severe live and dead loads. It also describes how paved-invert and asbestos bonded pipe-arch solve erosion and corrosion problems. Tables give the recommended sizes and gages required to meet various loading conditions.

34 DRAWING PEN

John Henschel and Co., Inc.—Imported Pelican Graphos, the drawing ink fountain pen, has 54 changable nibs for art lettering, technical drawing and sketching. Points draw lines from a hairline to 3/8 in. thick. Also available is Pelican ink in nineteen vivid colors.

35 DRAWING PENCIL

Eagle Pencil Co.—Will furnish a free sample of their improved Turquoise drawing pencil with 100 percent electronic graphite. Specify degree of hardness desired.

36 DRAWING PENCILS

J. S. Staedtler, Inc.—has imported Mars Lumograph drawing (wooden) and artist (chuck) pencils as well as lead refills. They come in nineteen degrees, from EXEXB to 9H with accurately graded leads. A sample and folder will be sent on request.

37 DRILLING BITS

Herb J. Hawthorne, Inc.—The illustrated "Blue Demon" Bit Catalog, No. 502, will be of interest to engineers and contractors engaged in dam, bridge and road construction. Low cost "Blue Demon" bits, now available in AX, BX and NX sizes, are being used extensively for grout hole drilling and foundation testing in sedimentary formations and effectively doing the job of high cost bits.

38 DRY CHEMICAL FEEDER

Permutit Co.—Bulletin 3156 outlines the principles and design of the dry chemical feeder. The advantages of this type of feeder are: extreme accuracy, wide feeding range, stepless adjustment of dosage, reproducibility of feeding rate for any feeder setting, adaptability to either acid or alkaline chemicals.

39 ECHO DEPTH RECORDER

Bludworth Marine Div. of National-Simplex-Bludworth, Inc.—A specification sheet describing Model ES-123 Supersonic Echo Depth Recorder is offered. This instrument provides a permanently recorded graph of underwater contours as well as an indication of the constituency of bottom materials. Underwater survey groups, dredging companies, bridge builders and underwater pipeline companies will find this equipment most interesting.

Order Your Literature Now by mailing the coupon on page 88 to CIVIL ENGINEERING.

40 EFFECTS OF CALCIUM CHLORIDE

Solvay Sales Div., Allied Chemical & Dye Corp.—has prepared a 40-page semi-technical booklet, of interest to architects, engineers and others concerned with specifications, design or production of Portland cement concrete. This booklet contains tables, graphs and charts covering setting time, early strength, curing, slump, density, surface wear, shrinkage, and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air entraining, high early strength and low heat cements.

41 ELECTRICAL METALLIC TUBING

Republic Steel Corp.—A catalog answering such questions as what electrunite E.M.T. is, where it can be used, and why it should be specified has just been released. A chart on size ranges is also included.

IT IS REQUESTED THAT STUDENTS AND EDUCATORS WRITE DIRECT TO MANUFACTURERS.

42 ENGINEERING INSTRUMENTS

W. & L. E. Gurley—An illustrated 64-page catalog, No. 50, describes the complete line of Gurley engineering instruments. Descriptions and specifications of several types of transits, levels, alidades, leveling and stadia rods, and plane tables with accessories are listed. Dip needle, cruising and geologists compasses are included, as well as current meters, water level recorders and wind instruments.

43 EXCAVATOR-CRANE

Hyster Co.—The improved Hystaway excavator-crane, described in catalog, No. 1170, is a versatile production-utility, tractor-mounted machine which provides a ½-yd shovel, backhoe, dragline, clamshell and crane as interchangeable features. Designed for D6, D7 and D8 "Caterpillar" track-type tractors, the all-in-one tool mounts on either new or used machines, and utility use of the bulldozer on the rear of the tractor is possible with any component of the Hystaway due to retention of full tractor mobility and maneuverability.

44 FACILITIES & PRODUCTS

Newport News Shipbuilding & Dry Dock Co.—Illustrations on everyone of the 40-pages of this attractive book show some of the company's facilities and products in the process of manufacture. A wide range of facilities as to function, type, and capacity, together with a trained organization, are needed for the building of large compact vessels, producing rayon-yarn-spinning machinery, steel pipe lines, tanks, valves, gates, and a variety of equipment designed especially by the user.

45 FILTER-CLARIFIERS

Hardinge Co. Inc.—A 4-page bulletin, No. 30-B, describes the Hardinge sand filter-clarifier and discusses its capacities, operating principles, advantages, and includes operating data.

46 FIRE RETARDANT WOOD

Koppers Co., Inc.—A 12-page booklet describes the properties and characteristics of pressure-treated fire retardant wood. Standard specifications for pressure treatment of building lumber with CZC (FR) for fire retardance are given. Pictures and description of burning test and of typical installations are also included.

47 FLASH MIXERS AND FLOCCULATORS

The Dorr Co.—The 8-page, two-color Bulletin No. 6971, entitled "Dorrco Flash Mixers and Dorrco Flocculators" contains photographs and complete descriptions of these units as well as the advantages attending their use. This bulletin also covers the various types of Dorr sedimentation units and illustrates by photographs and drawings the ease with which the flocculator operates in combination with these units.

48 FLUORIDATION

% Proportioneers, Inc. %—Bulletin SAN-9 gives the complete story on the feeding of fluorides for the reduction of dental caries. It explains the methods of feeding sodium silico-fluoride and hydrofluoric acid under pressure. Special attention is given to the accurate control of feeding in strict proportion to the flow. Equipment is described for feeding into pressure line.

49 FOOTWALKS

Wm. F. Klemp Co.—offers a 1951 edition of their catalog entitled "Klemp Open Steel Grating and Stair Treads, the Perfect Structural Steel Flooring," containing information on riveted and welded grating, structural steel footwalks, bridge decking and drain grating, for use in refineries, power houses, sewerage units, mezzanine storage rooms, catwalks, heavy industries, bridges, etc.

50 FORM BUILDING

Symons Clamp & Mfg. Co.—A bulletin gives full construction details for contractors interested in building their own forms, using the Symons Forming System. Specific information and tables give complete, pertinent information on concrete pressure and what causes heavy pressure in concrete. The use of panel ties and walers is also explained in relation to concrete pressure.

51 FORMING SYSTEM

Symons Clamp & Mfg. Co.—announces the availability of its latest 4-page bulletin describing and illustrating in condensed form its forming system for concrete wall construction. Erecting and stripping advantages are explained in a short factual manner. The system and what it consists of is described. Assembly details and standard sizes are explained. Detailed information is given on the wood, plywood, plywood with magnesium frames and all magnesium forms.

Barber-Greene

MODEL 543 BUCKET LOADER...

SAVES man power-truck time-money

LOADS all free-flowing materials at 3 yrds. per minute

Cost studies prove that nothing can compete with a Bucket Loader in lowest cost loading from stock piles to trucks.

The B-G constant flow principle virtually eliminates the human element — guarantees the same hourly production all day long, whether the operator is fresh or tired out.

The new Barber-Greene Model 543 is the last word in loading economy. Backed by over a billion cubic yards handled by its predecessors, this machine is ready to cut your loading costs.

The new hydraulically controlled trimmer-conveyor combines with time-proved B-G advantages — such as the Spiral Feed, Cleanup Scraper, automatic Overload Release and Floating Boom — to save appreciable manpower on every job. With its 15 m.p.h. road speed, the 543 can get to the job fast and move from pile to pile in a hurry. It is built for high production through years of low-cost service. In addition, it is convertible to a Snow Loader for year-round usefulness.

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Constant flow Equipment

LOADERS · PERMANENT CONVEYORS · PORTABLE CONVEYORS · COAL MACHINES · BITUMINOUS PLANTS · FINISHERS · DITCHERS

CATALOG DIGESTS

52 FOUNDATIONS

Drilled-In Caisson Corporation—Literature describes foundation columns anchored in rock sockets; heavy column loads carried on single caissons; penetration through any type of soil to rock at any depth; examination of rock can be made; economy in time and labor; foundation bonded in rock; description, design, specifications technical data.

53 FOUNDATIONS AND HEAVY CONSTRUCTION

Spencer, White & Prentis, Inc.—Literature on the construction of difficult and unusual foundations, description of concrete-filled steel tubes driven to rock, including technical data, performance and installation, description of Pretest Underpinning and the application of the Pretest Method to construction other than foundations; Pretest foundations; caissons; foundations under existing buildings; shoring and moving buildings.

54 FOUNDATIONS AND SOIL BORINGS

MacArthur Concrete Pile Corp.—A booklet giving concise data on pile foundations describes cast-in-place, composite, steel, sectional pipe, timber and H piles. Also given are notes on soil and rock exploration, and pile driving problems with special notes and engineering information covering 41 years' experience installing cast-in-place concrete piles.

55 FOUNDATIONS AND UNDERPINNING

Underpinning & Foundation Co., Inc.—Of special interest to engineers is literature describing steel pipe pile foundations and underpinning by pioneers who have specialized in this field; application design and methods are included. The scope of this company's work also includes the installation of steel H-beam piles, timber piles, open and pneumatic caissons subway and tunnel construction, sinking of mine shafts, cofferdams, and all other types of substructures and heavy construction.

56 GRATING-FLOORING AND TREADS

Irving Subway Grating Co., Inc.—Catalog F-225 contains illustrations, descriptions and engineering data on grating-flooring, treads and floor armoring (riveted, press-locked, welded types)—safe, durable, fireproof, ventilating, clean and economical—for industrial and power plant and refinery walkways, stairways, driveways, trucking aisles; ship cat-walks and engine room floors and treads; locomotive, freight and passenger car runways and treads; roadway armoring, expansion joints, catch basin covers; bridge decking.

57 GRID ROLLER

Hyster Co.—A 6-page catalog, No. 1175, describes the Hyster grid roller for salvaging bituminous pavement. Two drums, each 67 in. in diameter, are mounted on a common shaft and attached to the frame for towing behind a "Caterpillar" motor grader, DW10 or track-type tractor. Design of the grid results in high-pressure points which fracture and break up bituminous chunks. Old material disintegrated by the roller can be reused and time and equipment saved by the method are substantial.

58 GUNITE

Pressure Concrete Co.—has a 48-page illustrated booklet on "Gunite" in all of its phases. This booklet contains specifications, job stories, and illustrations showing "gunite" repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks, bunkers, etc.

59 HEAVY DUTY MACHINE

American Steel Dredge Co., Inc.—offers a bulletin on "The Bushwacker," a heavy-duty machine for clearing land through the disintegration of brush, vines, undergrowth and trees. It contains information on its construction, operating principles and performance, as well as many action photographs.

60 HIGHWAY DESIGN

American Association of State Highway Officials—A one-volume edition of policies on geometric highway design is offered. The edition includes eight separate design policies such as: grade separations for intersection highways; intersections at grade; highway types (geometric); rotary intersections; highway classification, etc. This book is priced at $3.25 per copy.

N. B. There is a charge for this edition. Make checks payable to the American Association of State Highway Officials.

CATALOG DIGESTS

61 HYDRANTS AND GATE VALVES

R. D. Wood Co.—A 22-page booklet, "Mathews Modernized Hydrant," gives detailed description of its various features, with numerous photographs and sectional views to clarify the text. Appropriate space is devoted to the removable barrel, containing all the working parts, to the completely revolving head, and to the Sand-Spun protection case. A portion of this booklet is an illustrated treatment of gate valves that stay reliable under severe service conditions.

62 HYDRAULICS CALCULATOR

American Concrete Pipe Assoc.—A circular slide rule based on the Manning Formula is available to engineers. It will solve problems involving rates of flow, velocities, or slopes for pipes from 4 to 72 in. in diameter. Roughness coefficient "n" can vary from 0.008 to 0.020. Rate of flow can be in gallons per minute, million gallons per day or cubic ft per second. Price is $3.00.

N.B. There is a charge for this slide rule. Make checks payable to the American Concrete Pipe Assoc.

63 HYDROPEL

Stancal Asphalt & Bitumuls Co.—An illustrated booklet describes Hydropel—an integral waterproofing admix of remarkable efficiency for concretes and mortars. It also protects concrete against alkaline salts and freeze or thaw actions. It improves workability and allows added flexure. Also available is a list of publications on numerous other uses of asphaltic emulsions for road and airport construction.

64 INDUSTRIAL PRODUCTS

Johns-Manville—The 40-page catalog contains descriptions, sizes, illustrations, and application data on the following J-M products: "Transite" asbestos-cement pipe, friction materials, packings and gaskets, refractory products, electrical products, asbestos products and industrial building materials.

65 INSTALLATION MANUAL

Armco Drainage & Metal Products, Inc.—A 46-page manual describes the proper methods of installing drainage products. It discusses the handling of metal drainage structures, location, and proper excavation and preparation of base in various foundation soils and rock. Also included are detailed instructions for assembly of corrugated metal pipe, pipe-arches, hel-cor pipe, and multi-plate pipe and arches, as well as recommendations for proper backfilling. Detailed sketches illustrate important installation recommendations.

66 MAGNESIUM FRAMED FORMS

Symons Clamp & Mfg. Co.—A 14-page, well illustrated booklet, tells all about plywood forms in magnesium frames, for those in the construction field interested in new, modern methods of form construction. Plywood faced panels in magnesium frames are readily interchangeable with all magnesium panels. General direction for setting up and caring for the forms are also included in the booklet. Ingenious accessories further simplify the use of Symons forms.

67 MAIN STERILIZATION

Proportioneers, Inc.—Bulletin No. SM-9365, is a standard method bulletin on main sterilization and gives directions, calculations, typical main sterilization specifications, a water main sterilization chart and a description of the equipment required.

68 MASONRY AND CONCRETE DIAMOND BLADES

Clipper Mfg. Co.—Information in Circular No. 134 on bonded diamond blades that are available in numerous specifications in bronze, nickel and steel bonds for use on all kinds of masonry and concrete saws is offered. On hard, dense, vitreous materials bonded diamond blades are especially recommended—cutting two to three times faster, with smooth, effortless results.

When ordering literature for which there is a charge, please make checks payable to the company offering the material!

CATALOG DIGESTS

69 MASONRY SAWS

Clipper Mfg. Co.—offers in Circular No. 98 the latest information illustrating and describing masonry saws that cut in seconds—glazed tile, concrete block, roofing tile, glass block, stone, refractories and all kinds of masonry materials. Also, data on Clipper's free trial offer is included.

70 MECHANICAL PIPE JOINTS

R. D. Wood Co.—A 4-page leaflet describing mechanical joints that meet the requirements for permanent tightness of pipe joints under conditions of deflection, expansion, contraction and vibration. They are designed for high-pressure lines for oil, gas, water, steam, or chemicals.

71 METERING WATER FLOWS

Sparling Meter Co.—Meters that can be completely installed and maintained on main lines by water department personnel are gaining ever-wider acceptance. Sparling Bulletin 310 illustrates the adaptability of the propeller-type meter for long service, accuracy, conservation of pressure, and simplicity of operation. Accuracy curves, installation suggestions, and details of instruments are given with prices.

72 MIXED FLOW PUMPS

Economy Pumps, Inc.—Mixed Flow Volute Type Pumps are the subject of a new catalog No. F-1049. Designed for high speed transfer of liquids that may contain light solids, mixed flow pump applications include sewage disposal, irrigation, raw water pumping, reduction, and similar pumping operations. The catalog features construction details, photographs, drawings, and a selection table covering applications of these pumps of various sizes

73 MOTOR OIL

Standard Oil Co. (Indiana)—The booklet entitled "Stanolube HD Motor Oil" is a technical description and definition of heavy duty motor oils, illustrating through charts, photographs, and other data how Stanolube HD has demonstrated its ability to cope successfully with the most difficult problems of lubrication in automotive, diesel and HD engines.

74 MOTOR SWEEPER

Austin-Western Co.—An 8-page catalog, AD-2042, pictures and describes the Model 40 motor sweeper with its unique direct broom-to-hopper sweeping which makes unnecessary the conventional belt conveyor or squeegee elevator. While designed primarily for use by municipal street and park departments, the Model 40 is also well adapted to use on airports, and in and about industrial plants of many types. Included in the catalog are brief specifications and photographs of the sweeper in operation on typical jobs.

75 NON-CLOG PUMPS

Economy Pumps, Inc.—Applications for vertical non-clog open shaft pumps include sewage disposal, flood control, reduction, drainage of liquid containing sand or silt, food pulp distribution, and use in paper mills for stock pumping, water supply, and overflow. Complete selection table included in catalog No. F-249.

76 OIL FIELD PUMPING CATALOG

International Harvester Co.—has announced an oil field pumping engine catalog. This attractive two-color 16-page catalog, form A-384-NN, contains pictures, sectional views and capacity charts on five natural gas models designed for oil field pumping. Also included are International engines' A.P.I. horsepower curves.

77 OPEN STEEL FLOORING

Kerlow Steel Flooring Co.—A 40-page catalog on open steel flooring for bridges contains latest engineering information on design and selection of grating and stringers. Catalog describes various designs and their applications for open flooring and filled slabs, with dimension charts, complete specifications, selection and installation data for each design.

78 PENCILS

J. S. Staedtler, Inc.—A folder and sample of the imported tradition chroma colored pencils for blue print as well as general use, is available. They come in sixteen colors including four for blue prints. Strong leads are not water soluble. They sharpen to fine or blunt point.

CATALOG DIGESTS

79 PENCIL SKETCHING

American Lead Pencil Co.—24 pages of helpful illustrated instructions on pencil sketching Only 25¢ with two free Venus drawing pencils.

N. B. There is a charge for this book. Make checks payable to the American Lead Pencil Co.

80 PILES

Raymond Concrete-Pile Company—Raymond Standard and Step-Tapered Piles are described in literature which also includes information on the scope of Raymond's activities which cover every recognized type of pile foundation including cast-in-place concrete, precast concrete, composite, wood and concrete, steel, pipe, and wood. Raymond's activities and experience also include the construction of caissons and construction involving shore protection, shipbuilding facilities, and harbor and river developments.

81 PILES AND CAISSONS

Western Foundation Corp.—An 8-page bulletin on concrete piles and caissons is offered. Services performed by Western Foundation are enumerated and seven types of cast-in-place concrete piles such as: the button bottom, concrete pedestal, compressed concrete, and wood composite, are outlined in the catalog.

82 PIPE CEMENT LINING

Centriline Corp.—A booklet describes the method for placing a thin cement mortar lining on the inside surface of pipes in place. Also shown are typical installations and results which can be expected in pipes reconditioned after many years of use with a minimum interruption of service.

83 PIPE LINING

Pipe Linings, Inc.—"Tate Process", a 10-page, illustrated, multi color bulletin, covers a method of lining smaller diameter water, oil, or gas pipe lines in place. The service cleans corroded matter and tubercles from pipe walls and applies smooth cement-mortar lining.

84 PITOT EQUIPMENT

Simplex Valve & Meter Co.—Bulletin No. 50 is a complete publication on the choice and use of Pitot equipment. Descriptive material covers instructions for use of Simplex Pitot tube and manometer, instructions for operation and use of Simplex portable Pitot recorder and, in addition, contains an entire section applied to theory, formulas, notations, tables and curves relating to Pitot tubes, manometers and recorders.

85 PLANT CONSTRUCTION

F. H. McGraw & Co.—An illustrated brochure and quarterly picture magazine entitled "Plans & Projects" describes how this progressive industrial construction company handles difficult plant building problems. Publications also give history of the company and accomplishments as well as current developments and records of outstanding engineering and construction personnel.

86 POCKET INSTRUMENTS

Keuffel & Esser Co.—A leaflet entitled, "Right Angles with Pocket Instruments," will be of interest to engineers, builders, etc. Such instruments as the right angle prism, the right angle mirror and the double right angle prism are described, and figures and illustrations show how the instruments are used.

87 POCKET TRANSIT

Wm. Ainsworth & Sons, Inc.—A booklet describing and outlining the use of the Brunton pocket transit and accessories is available. The booklet shows how horizontal and vertical angles can be determined to approximately one degree by using an instrument weighing only 8½ ozs. This will be of interest to engineers who have occasion to make rough surveys, check grades and levels, or lay out roads or lines.

88 POWER DISTRIBUTION

General Electric Co.—A 24-page booklet shows "What Load-Center Power Distribution can do for you." It gives information on judging the merits of a plant power system, and shows the contrast between old systems and new. Diagrams and charts are included.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

CATALOG DIGESTS

89 POWER GRADERS

Austin-Western Co.—A 24-page catalog AD-2112 pictures and describes the "88-H," the "99-H" and the Master "99" power graders with exclusive all-wheel drive and all-wheel steer. All types of work—rough grading, heavy ditching, scarifying, snow plowing, terracing and drainage, mixing, loading, rolling and bulldozing—are illustrated and discussed. Included also are brief specifications, a description of exclusive design features and detailed illustrations of the attachments.

90 PRECIPITATOR

Permutit Co.—Bulletin 2204A describes the Permutit precipitator which offers a new and more efficient means for removing impurities from water by precipitation, adsorption, settling and upward filtration. It requires less space, less chemicals and less time than any previous design of reaction and settling tank.

91 PRELIMINARY SURVEY PROCEDURE

American Paulin System—This booklet, available without charge to all civil engineers, is published in the interests of greater efficiency and economy of time and labor in the making of preliminary surveys under all conditions. The observer and author of this work, Raymond A. Hill, M. ASCE, explains in detail the practical use of the Paulin System Altimeter in connection with all branches of preliminary field surveying. Geologists, scientists, topographers, surveyors and educators will find this book of interest and technical value.

92 PREMOLDED JOINT SEALS & FILLERS

Servicised Products Corp.—A 12-page catalog describes in detail a complete line of premolded joint fillers and the entirely new line of premolded bituminous rubber sealing strips. It gives complete specification data of value to engineers particularly concerned with heavy concrete construction.

93 PRESSURE-CREOSOTED PILES

Koppers Co.—A 16-page booklet designed to assist engineers in the evaluation of pressure-creosoted foundation piles for various types of construction projects has been issued. The booklet cites important national, regional, and city construction codes which allow pressure-creosoted wood foundation piles for permanent construction. Typical examples of the use of these piles are described and pictured.

94 PRESSURE GROUTING INFORMATION

Gardner-Denver Co.—offers Bulletin P-60 on pressure grouting information. Construction details of the Duplex high pressure steam pumps for grouting service, stationary air compressors, and hand held drills are given, and are supplemented with charts, diagrams and illustrations and other informative matter.

95 PRESSURE VESSELS

Chicago Bridge & Iron Co.—A 4-page leaflet "Spherical Pressure Vessels for Sewage Gas" describes the advantages of storing digester gas in a Hortonsphere at sewage disposal plants. The method of determining the amount of useable gas that can be stored in a Hortonsphere is discussed and includes a typical example.

96 PRINT MARKING PENCILS

Eberhard Faber Pencil Co.—announces a new assortment box No. 4006 of six scientifically chosen colors recommended for reproduction. The six Colorbrite pencils included were selected for high-visibility on every type of print, are brilliant even under dim lighting, corrections won't smear, won't fade, won't blur when wet. These colors include: light blue, chrome yellow, white, orange, scarlet, and light green. A free sample of any two colors will be sent on request.

97 PRODUCTS AND PROCESS

Infilco Inc.—"Products and Processes for Industry" is a comprehensive bulletin recently published. It is a worthwhile manual for all who are responsible for the selection of water conditioning, sewage and trade waste treatment equipment.

98 PROTECTIVE COATINGS

Koppers Co., Inc.—An informative packet of assorted brochures concerning Koppers protective coatings is offered. The bulletins describe: Bitumastic hi-heat gray for high-temperature corrosion prevention; Bitumastic black solution for general, low-cost maintenance; Bitumastic super-service black, heavy-duty coating for more severe conditions, etc. A visual coatings application guide and a coatings application manual also are included in the packet.

CATALOG DIGESTS

99 PUMPS

Johnston Pump Co.—offers two bulletins about industrial applications for their vertical turbine pumps and general applications of their vertical propeller pumps. Bulletin 1017 illustrates the design features and applications of the vertical turbine pump as applied to industrial service. Bulletin 1024 covers the features, applications and selection tables of the vertical propeller pump. Both bulletins have numerous illustrations and are printed in full color.

100 RACK RAKE

Newport News Shipbuilding & Dry Dock Co.—The illustrated 15-page booklet outlines uses for the Newport News mechanical rack rake, a power-operated rake for cleaning trash racks at water intakes for hydroelectric plants, steam plants, pumping stations, canals, and similar installations. Included in the booklet are drawings for a number of typical installation arrangements.

101 REFERENCE CHART

Concrete Reinforcing Steel Inst.—A "Bar Card", covering latest ASTM Specification A-305 reinforcing bars is offered. The card serves as a ready reference chart of weights (lbs per foot) and nominal dimensions (diameter, cross-sectional area, and perimeter) for the standard sizes of steel reinforcing bar from 1/4 in. thru 1-1/4 in. Listed on the back are standard ASTM designation numbers for reinforcing bars, including those covering "grades of steel," and "deformed bars."

102 REPRODUCTION MATERIALS

Eastman Kodak Co.—The publication entitled, "Modern Drawing and Document Reproduction," describes in considerable detail the characteristics and properties of Kodagraph reproduction materials. These materials have been specifically designed to quickly, easily and at low cost reproduce copies of any written, typed, drawn, or printed matter. The papers are silver-sensitized photographic materials and produce results of unexcelled quality, lasting legibility, and outstanding uniformity. Kodagraph chemicals, Kodalith films and papers, and Kodagraph micro-file equipment are also described in the booklet.

103 RETAINING WALLS

Armco Drainage & Metal Products, Inc.—A 16-page booklet, "Armco Bin-Type Retaining Walls", describes how the retaining walls are used and how strength plus flexibility is incorporated in their design. Photographic descriptions show how they are simply and economically installed with a minimum of excavation. Case histories also show application of the walls for embankment stabilization along highways, railroads, lakes, streams, and city streets. Technical data on selection of walls for typical applications is also included.

104 ROAD MACHINERY

W. E. Grace Mfg. Co.—has the following literature available: Form TS on road sweepers, which includes sweepers of the trailer type, sweeping right and left both traction or engine driven; Form SF on sheepsfoot rollers, from 112 to 765 psi foot pressure, for earth fills, road bases and airports; Form SB on spreaders for covering asphalted surfaces with gravel; Form RK on barrel heating kettles, for melting asphalt from drums; and Form AP on asphalt pumps for asphalt or thick liquids.

105 ROCK DRILLS

Worthington Pump and Machinery Corp.—Bulletin H-1200-B42, describes the WJ-45 and the WJ-55 hand-held rock drills, shows their use, and advantages. A list of specifications is also included.

106 ROLLING DOORS

Kinnear Mfg. Co.—The 16-page fully illustrated Bulletin No. 68 on a galvanized steel sectional overhead type door that combines durability with operating convenience and facilities for glass light sections in a door for all types of commercial and industrial service openings is offered. It gives details, clearance requirements and available accessories.

107 ROLLING DOORS

Kinnear Mfg. Co.—offers Bulletin No. 37-A which shows the ideal substitute for metal rolling doors in case defense demands make adequate steel, aluminum, etc., unavailable. The time-proved product operates on the same principle of efficiency as steel rolling doors, and is built in any practical size for any type commercial or industrial service opening.

CATALOG DIGESTS

108 ROOFING

Koppers Co., Inc.—A 36-page manual gives detailed specifications for application of coal tar pitch and approved tarred felt roofs (both flat and steep) on wood decks, poured concrete and gypsum decks, precast concrete slab decks, and precast gypsum steel plank decks, etc. Specifications for re-roofing, insulating, application of flashing, and the use of Koppers waterproofing and damproofing materials also are included.

109 SAND & STONE HANDLING

Link-Belt Co.—The 64-page Book No. 2126, covers conveyors; bucket elevators; vibrating and revolving screens; sand washing, dewatering, separating, classifying equipment; bin gates; conveyor idlers; power transmission machinery; and completely equipped sand and stone preparation plants. The book is full of illustrations and application data to assist the user.

110 SEWAGE REGULATORS

Brown & Brown, Inc.—Bulletin 81 with supplements A and B describes sewage regulators designed to automatically control diverted sanitary flows from combined sewer systems either by cutting off such flows entirely during storm periods or by governing such diversions to a constant predetermined quantity regardless of storm conditions. Charts for the ready solution of diversion problems are included.

111 SIMPLEX EQUIPMENT

Simplex Valve & Meter Company—A general description of the complete line of Simplex equipment is offered in Bulletin 002. The bulletin describes and illustrates Venturi tubes, rectangular and circular chart type meters, controllers and gauges and methods of auxiliary close-off devices. It illustrates type "S" parabolic flume, W-K tap arrangements, manometers, pilot equipment, air inlet and air release valves.

112 SOIL SAMPLING EQUIPMENT

Sprague & Henwood, Inc.—The most complete publication on soil sampling equipment is found in Bulletin No. 75-A. Types of samples, value of samples and sample testing are described in this bulletin as well as equipment recommended for the taking of the actual sample in various formations.

113 SPEED-LAY PIPE SYSTEMS

Albert Pipe Supply Co., Inc.—A 5-page brochure describing "packaged" pipe line for temporary and semi-permanent air, gas and water lines is offered. This line is available in sizes 2 to 12 in., or larger if desired. It is lightweight, portable, easily assembled and available for prompt shipment. Includes pipe, couplings, fittings, adapters and valves where necessary.

114 STAINLESS STEEL TUBING

Republic Steel Corp.—A 27-page catalog on Electrunite Enduro stainless steel tubing tells how it serves, describes the types of tubing, features applications, fabricating data, tubing data tables, engineering data, specifications, a size range chart, and other steel and tube products.

115 STEEL BEARING PILES

United States Steel Co.—A 100-page book presents comprehensive data and illustrations of the current practice in the design and use of the new steel CBP section bearing piles. In addition, there is an extensive review of the use of steel bearing pile sections, with records of tests of the past uses and applications.

116 STEEL FLOORING INSTRUCTIONS

Wm. F. Klemp Co.—offers its 1951 edition of a technical manual entitled "Instructions for Laying Klemp Hexteel and Floor-steel." Hexteel heavy duty surface armor is an open-steel grid, solid, enduring and self-anchoring. Floorsteel flexible floor armor is an open steel mat. Both are used to armor and reinforce bridges, docks, air landing strips, loading platforms, industrial floors, heavily traveled highways and catalytic cracking units. The book contains complete engineering data.

117 STEEL FORMS

Economy Forms Corp.—A booklet on steel forms for concrete construction is offered. It has numerous pictures showing the simple handling, applications, and use of the forms for all types of heavy construction; tunnels, culverts, sewage & water treatment plants. Special forms designed to solve concrete construction problems are also shown.

CATALOG DIGESTS

118 STEEL SHEET PILING

United States Steel Co.—A 56-page booklet gives detailed discussion of the uses, characteristics, and assembly of the three general types of steel sheet piling sections; the straight web, the arch web, and Z-piles. Following this discussion are complete tables of wall dimensions, cellular structures, accessories, and weights for all sections, plus diagrams of the individual sections, walls, corners, cellular structures, cofferdams, bulkhead and piers, and caps or copings.

119 STEEL TUBING

Republic Steel Corp.—The booklet describes Elyria structural steel tubing, and lists its characteristics. Two pages are devoted to fabricating data, and standard sizes and wall thicknesses are shown in tables.

120 STRUCTURAL SHAPES

United States Steel Co.—Attractive 72-page book, "Hot Rolled Carbon Steel Structural Shapes," contains complete properties and dimension tables of all available structural shapes, including diagram drawing of each. Also includes plate-size limitations and basic structural data on bearing piles, steel sheet piling, floor plate, crane rails, and corrugated sheets.

121 SUBSURFACE EXPLORATION

The Giles Drilling Corp.—An 8-page pamphlet describes advanced subsurface exploration techniques in test borings for engineering. Emphasis is laid upon the fact that every engineering exploration, presents its own individual subsurface conditions and problems. This places a premium upon correct field technique and interpretation.

122 SUMP PUMPS

Economy Pumps, Inc.—Construction details, applications, and detailed installation drawings of Economy VSL and VS general service sump pumps are featured in a new catalog. These pumps are suitable for automatic drainage of pits, basements, and similar constructions. A selection table for specific application of pumps, ranging in capacity from 30 to 150 U. S. gal per min is contained in Catalog No. E-748.

123 SURGE RELIEF VALVE

Golden Anderson Valve Speciality Co.—An 8-page bulletin No. W-2, discusses the "cushioned" surge relief valve's adaptability, adjustment, operation, servicing and complete description and valve patterns. There are also five pages of detailed diagrams showing parts, a general list of materials, dimensions, installation arrangements, and specifications.

124 SURVEYING ALTIMETER

American Paulin System—has a catalog giving specifications on Micro and Terra surveying altimeters together with comparative explanation of instrumentation systems in this field.

125 SURVEYING ALTIMETER DEVELOPMENT

American Paulin System—offers their interesting and instructive publication entitled "Origin and Development of the Barometer and Altimeter." This booklet will acquaint civil and field engineers with the basic differences between their system of instrumentation and all other types in the field of surveying altimeters.

126 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—Catalog "F" describes the full Berger line of transits, levels, theodolites, alidades and special instruments made by that company for 80 years. A well illustrated brochure (N 648) is available on request for preliminary information.

127 SURVEYING INSTRUMENTS

Norbert Dienstfrey—is issuing 1951 descriptive circulars and books on the Fennel tacheometer for quick surveying and mapping, the new precise levels—Plani and Nitac, and precise transits and theodolites.

128 SURVEYING INSTRUMENTS

Jarrell-Ash Co.—Watts surveying instruments of advanced design are described in separate brochures for transits (theodolites), levels, alidades, and magnetic variometers. New features include fast leveling, optical plummeting and glass scale reading.

CATALOG DIGESTS

129 SURVEYING INSTRUMENTS

David White Co.—The 40-page Bulletin No. 1050, containing information on engineers, surveyors and builders instruments is available. In addition to this, alidades, plane tables, etc., are fully listed.

130 SURVEYING INSTRUMENTS

Henry Wild Surveying Instruments Supply Co., Inc.—An attractive folder gives condensed technical data on time-saving optical transits and levels. Also, illustrated literature on the new T-12 pocket theodolite is now available. The recently developed instrument, with a total weight of 7 lbs, including packing container and folding-leg tripod, is speedily used for preliminary surveys, reconnaissance work and construction.

131 SWIMMING POOL EQUIPMENT

Permutit Company—Complete information and specifications are contained in Bulletin 2157 on Permutit recirculation and purification equipment. This includes information on alum and alkali feeds, filters, rate of flow controllers, automatic pH controls, chlorinators, test kits, suction cleaners and zeolite water softeners.

132 SWING CHECK VALVE

Golden-Anderson Valve Specialty Co.—Bulletin No. W-1, entitled "Cushioned Swing Check Valve," discusses the installation, operation, adjustment and general dimensions of the valve. A list of parts, specifications and a general list of materials are included in the informative bulletin.

133 SYNCHRONOUS MOTORS

General Electric Co.—offers a bulletin on low-speed synchronous motors for low-cost efficient drives. A detailed description of the perfection of construction of each part of the motor is given, as well as a listing of the services performed.

134 SYNCHRONOUS MOTORS

General Electric Co.—Bulletin GEA-4139A has information on GE Synchronous motors and control for compressor drive. The bulletin describes in detail, the precision synchronization, prompt field removal, and complete motor protection features.

135 SYSTEM OF MOTOR CONTROL

General Electric Co.—Bulletin CR 7095 contains information on Cabinetrol, a standard system of centralized low-voltage control. A complete description, fully illustrated, of the advantages of the new control system is given. It shows how Cabinetrol frees your engineers from tedious detailed planning, cuts installation time, saves space and improves plant appearance. The bulletin describes how a standard, but flexible system can be used to solve special control problems.

136 TECHNICAL BOOKS

John Wiley & Sons, Inc.—Information on authoritative, up-to-date technical books in all branches of science and engineering is available in the Wiley general catalog. Of particular interest to civil engineers are the descriptions of standard reference and textbooks on structural engineering, foundations, hydraulic and hydroelectric engineering, municipal engineering, architecture, irrigation, highway and bridge engineering, building construction, and many other related subjects.

137 TECHNICAL DATA BOOKS

Lefax—offers catalogs showing over 2000 listings of pocket size technical data books. Each data book contains 140 pages of technical data, presenting condensed, accurate and essential information for the student, engineer, technical worker and business man.

138 TIDE GATES

Brown & Brown, Inc.—Bulletins 69 through 73, 75 and 76 describe various types of tidal gates, both circular and rectangular, and give authentic information regarding head losses.

Please remember industrial literature is costly. It is requested that you ask only for those booklets of particular interest to you.

CATALOG DIGESTS

139 TIMBER BRIDGES

Timber Structures, Inc.—"Permanent Timber Bridges," a six page folder shows applications of engineered timbers in construction of permanent highway and railroad bridges. Bridge types discussed include deck arch, bowstring truss, composite deck, girder, and parallel chord truss. Practical span lengths and main structural characteristics are given, together with pictures of typical installations. Accompanying each of these installations are details of length, width, loading, deck construction, and drawings of elevation and cross section details.

140 TRACING PENCIL TEST KIT

American Lead Pencil Co.—The kit contains samples of Venus tracing pencils for testing on various types of tracing papers. This new pencil contains an active chemical to produce clearer, sharper white or blue prints when reproduction is made from a pencil drawing.

141 TRACTORS

Caterpillar Tractor Co.—A 40-page booklet, entitled "Caterpillar Products" contains a complete listing with pictures and brief specifications of all but two of the current line of products, 81 in all. The list of additions ranges from tractors to tool bars. Several application pictures show "Cat" diesel tractors and motor graders in action.

142 TREATMENT OF CONCRETE & MORTAR

Master Builders Co.—A 16-page illustrated booklet gives information and estimating data on 15 products for the treatment of concrete and mortar, such as: Pozzolith, for better, more economical concrete; Omicron mortarproofing, for tight brickwork; Masterplate, for wear resistant, spark resistant and static disseminating concrete floors; Embeco, for counteracting shrinkage in grouting mortar and patching concrete—also for surface treatments to reduce permeability.

143 TRUCK MIXERS AND AGITATORS

Worthington Pump and Machinery Corp.—Bulletin R-1700-B3 on the Ransome Hi-Up truck mixers and agitators is offered. The benefits that can be expected are listed, and some of Ransome's advanced engineering features are illustrated. Manufacturing techniques and the numerous refinements developed for the safety and convenience of the operator are described. Specifications are also included.

144 TUBES

Republic Steel Corp.—A 19-page catalog on Republic electrunite tubes is offered. The advantages are listed, and a pictorial presentation of the processes employed in the production of pressure tubes is shown. Specifications and approvals, and a table of maximum allowable working pressures are included.

145 TUNNELING

Commercial Shearing & Stamping Co.—Now available is a text book on tunnels and an introduction to tunnel geology by tunnel men. Entitled "Rock Tunneling with Steel Supports" by Karl Terzaghi, the book deals with specific information on tunneling, covering 300 subjects. The most comprehensive book of its type ever offered to the tunnel builder and designer. Price $2.50 per copy postpaid.

N. B. There is a charge for this book. Make checks payable to the Commercial Shearing & Stamping Co.

146 TUNNEL MIXERS

Worthington Pump and Machinery Corp.—Bulletin R-1700-B5, describes in detail Worthington's 35s dual drum tunnel mixers. Features and attachments designed for lower operating costs are presented with illustrations and descriptive matter. A page devoted to specifications and one to "Blue Brute" products for tunnel work is also included.

147 VACUATOR

The Dorr Co.—The 12-page, two-color Bulletin No. 6301, entitled "The Dorrco Vacuator" describes the modern unit in detail including installation photos, drawings and flowsheets illustrating its various applications in sewage treatment. The vacuator is a compact unit utilizing the principle of vacuum flotation and is giving remarkable results on a wide variety of municipal and industrial wastes.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

CATALOG DIGESTS

148 VENTURI METER

Simplex Valve & Meter Co.—Bulletin No. 400 describes in detail the operation and installation methods of the type H meter register. This is a circular-type chart instrument equipped with various forms of mountings and arranged for operation under the majority of hydraulic head conditions. A complete pipe size and meter capacity table provides a quick and ready reference when needed. This bulletin is of essential interest to any filter plant or sewage plant designing engineer.

149 VIBRATORS

Viber Co.—New applications and equipment development on interchangeable vibrator units, flexible drive, full depth internal concrete paving, rubber-tipped and Model PX-6 external vibrators are described in a recently published catalog. Specifications concerning speeds, weights, sizes, types of power, etc., are included.

150 WALL-FORM CONSTRUCTION

Symons Clamp & Mfg. Co.—A 34-page catalog on a system of wall-form construction is available. Illustrations show in detail how simply and easily the forming system operates. Actual jobs where Symons forms have been used are well illustrated—showing the forms in use as well as completed foundations. Also blue print illustrations and complete specifications are given—material and equipment necessary, time required and cost figures on actual jobs. The manufacturer advises that, by sending in plans and specifications, you will be furnished a free form layout of your job without charge or obligation.

151 WASTE TREATMENT

Infilco, Inc.—"Waste Treatment to Comply with Stream Pollution Control Regulations" is the title of Bulletin 70-A, explaining the "how" techniques of chemical, biological, and anaerobic waste treatment. It gives case histories and data of value to those responsible for waste treatment.

152 WATER AND SEWAGE PLANT EQUIPMENT

Infilco Inc.—Equipment for municipal water and sewage plants is covered in Bulletin 60-C, just recently revised. It includes the latest equipment available for efficient, economical water conditioning and sewage treatment.

153 WATER FILTERS

Proportioneers, Inc.—Bulletin 1800 describes Pur-O-Cel Diatomite filters for use in filtration of water in municipal and industrial water works and in swim pool recirculation systems. Engineering data on the application of these filters, including specifications and dimensions covering the complete recirculation and purification systems, are given.

154 WATER MEASURING AND SURVEYING INSTRUMENTS

Leupold & Stevens Instruments, Inc.—Data on water measuring and surveying instruments are contained in a convenient file folder. Water level, flow and precipitation recorders, and hydrographic accessory equipment such as enamelled iron gages, gaging reels, float gages and the like are described and data on the use of such equipment is included. Folders describing engineer's and builder's levels, hand levels and compasses, complete this engineer's file.

155 WATER POWER EQUIPMENT

Newport News Shipbuilding & Dry Dock Co.—An exceptionally attractive book, consisting of 75 pages, is offered free of charge to engineers interested in hydraulic turbines, butterfly valves, pressure regulators, penstocks, regulating gates and trash rakes. The booklet shows various plants throughout the United States using this equipment. Pictures, details of the development, sectional views, and an interesting synopsis of the company's hydraulic laboratory are included.

156 WATERPROOFING

Western Waterproofing Co.—A 4-page folder shows how Western has successfully added years to the life of a wide variety of school and university buildings through weather and water-damage protection, building and concrete restoration, tuckpointing and building cleaning.

157 WATERPROOFING

Western Waterproofing Co.—A well-illustrated folder explains the most effective methods of protecting masonry walls from water damage and dampness, by Western's "Parge" system for interior surfaces and their application of "Dilato" expanding mortar to exterior joints.

CATALOG DIGESTS

158 WATERPROOFING AND WEATHER-PROOFING

Western Waterproofing Co.—A comprehensive folder explains how to recognize concrete deterioration, what causes damage to concrete masses, and how Western's exclusive "Resto-Crete" system provides lasting restoration and protection of grain elevators and similar structures.

159 WATERPROOFING AND WEATHER-PROOFING

Western Waterproofing Co.—A folder shows how the company's complete and highly specialized services have restored, beautified and protected from deterioration a wide varfety of churches in all parts of the country.

160 WATER TREATMENT UNIT

The Dorr Co.—A 32-page, two-color, bulletin, No. 9041, entitled "The Dorrco Hydro-Treator" is available. The Hydro-Treator is a self-contained high-rate water treatment unit for the removal of hardness, turbidity, color and algae from municipal and industrial water supplies. The bulletin describes the unit in detail, covering such factors as its action, distinguishing characteristics, types and sizes and capacity ratings. Also included are complete drawings of the various available types of Hydro-Treators as well as tables and formulae useful to engineers engaged in water plant practice.

161 WELDED FABRIC

Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp.—A 2-color folder describes Clinton electrically welded fabric which has been successfully applied to every form of reinforced concrete construction. Some of its many uses are for concrete roads, streets, airports, floors, pipe, sewers and reservoirs. Structural advantages, ease of use and standard styles are listed.

162 WELLPOINT SYSTEM

Complete Machinery & Equipment Co., Inc.—A catalog describing the Complete Wellpoint System, shows its many advantages in installation, operation and cost-cutting economy. Also suggestions for installing the system are clearly stated and illustrated.

163 WELLPOINT SYSTEM

Griffin Wellpoint Corp.—"The Wellpoint System in Principle & Practice," describes how the wellpoint system functions, methods of planning, its layout, installation, operation, and removal.

164 WELLPOINT SYSTEM

Moretrench Corp.—"Working in the Dry with the Moretrench Wellpoint System" is the title of a 64-page catalog describing and illustrating the Wellpoint system and its use in dewatering various types of construction projects. It is amply illustrated with on-the-job photos.

165 WELLPOINT SYSTEM

John W. Stang Corp.—A new catalog on wellpoints is being issued. It contains illustrations and descriptions of many dewatering jobs. The booklet shows the use of Stang methods and equipment employed in small and large projects.

166 WELL WATER SYSTEMS

Layne & Bowler, Inc.—A booklet titled "Layne Well Water Systems," contains 48 pages crammed with photographs and drawings illustrating methods of drilling deep water wells. Subjects covered are underreamed gravel wall wells, rock wells, and special drilling such as core sampling for foundation soundings. A water conditioning section completes the story of the scope of Layne service. Useful engineering tables are included in the back.

167 WIRE FABRIC

American Steel & Wire Co.—A 178-page catalog furnishes useful information about welded wire fabric to those interested in construction, whether the interest be from the marketing, designing, or contracting viewpoint. The catalog contains tables and photographs showing uses of welded wire fabric.

168 WIRE ROPE

American Steel & Wire Co.—A 48-page well illustrated booklet shows many applications of wire rope with recommendations for various operating conditions.

CATALOG DIGESTS

169 WIRE ROPE

American Steel & Wire Co.—A handy pocket-sized 125-page catalog features all types and sizes of wire rope with tables for each type and size showing rope diameters, breaking strengths in pounds, weight per foot, etc. It also shows fittings and handling techniques.

170 WIRE ROPE

Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp.—The new Wickwire rope catalog offers a different approach to this difficult subject. Charts, tables, drawings, and photographs were included to present a fresh slant on wire rope. The catalog covers the characteristics, care, handling and describes wire rope for specific industries.

171 WIRE ROPE—LIFE AND COSTS

Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp.—Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 41 wire rope life savers, 20 diagrams, tables, graphs and charts.

172 BRIDGES

The Torrington Company—A 63-page, cloth bound book entitled "Anti-Friction Bearing Design for Movable Span Bridges," is available for distribution to bridge engineers. The book profusely illustrated, is devoted to vertical lift, bascule and other types of movable bridges showing designs of each and stating their advantages, with a general discussion of the use of anti-friction bearings in movable span bridge design.

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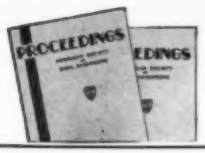

PROCEEDINGS AVAILABLE

The following papers, printed as Proceedings Separates, may be ordered on the basis of summaries given in this and previous issues of CIVIL ENGINEERING. Discussions of these papers will be received, as in the past, for a period of five months following the date of issue. A summary of each paper appears in several consecutive issues; other titles will be added every month, as they become available. Use the convenient order form on page 108.

Summarized in Earlier Issues

41. Ship Response to Range Action in Harbor Basins, by Basil Wrigley Wilson.

42. Wind-Load Standards in Europe, by John W. T. Van Erp.

43. Settlement Correction at La Guardia Field, by John M. Kyle.

44. The Problem of Wave Action on Earth Slopes, by Martin A. Mason.

45. Comprehensive Plan for the Columbia Basin, by William Whipple.

D-4. Discussion of Paper, **Capillary Phenomena in Cohesionless Soils,** by T. William Lambe.

D-5. Discussion of Paper, **Elastic Restraint Equations for Semi-Rigid Connections,** by J. E. Lothers.

D-10. Discussion of Paper, **Pollution Abatement Policy,** by Thomas R. Camp.

D-XXIII. Discussion of Symposium, **High-Velocity Flow in Open Channels.**

D-XXVIII. Discussion of Paper, **Movements in the Dessicated Alkaline Soils of Burma,** by F. L. D. Wooltorton.

46. Human Aspects of Mexican Irrigation, by Antonio Rodríquez L.

47. Operation and Maintenance of Irrigation Systems, by Raymond A. Hill.

48. Compaction of Cohesive Soils: Progress Report of the Subcommittee on Consolidation of Materials in Earth Dams and Their Foundations of the Committee on Earth Dams of the Soil Mechanics and Foundations Division.

D-XXVII. Discussion of Symposium, **Design Characteristics of Lock Systems in the United States.**

D-2. Discussion of Paper, **Public Utility Condemnation Cases in the State of Washington,** by Henry L. Gray.

D-3. Discussion of Paper, **Treatment of Foundations for Large Dams by Grouting Methods,** by A. W. Simonds, Fred H. Lippold, and R. E. Keim.

D-9. Discussion of Paper, **Atchafalaya Diversion and Its Effect on the Mississippi River,** by Leo M. Odom.

49. Large Hyperbolic Functions Computed by Fission, by F. T. Llewellyn.

50. Supersonic Sounding Instruments and Methods, by Joseph M. Caldwell.

51. Laterally Loaded Plane Structures and Structures Curved in Space, by Frank Baron and James P. Michalos.

52. Some Aspects of Electronic Surveying, by Carl I. Aslakson.

Third Notice

53. Wedge-Beam Framing, by Arsham Amirikian.

54. Truss Deflections by the Coordinate Method, by Kuang-Han Chu.

55. Measurement of Sedimentation in Small Reservoirs, by L. C. Gottschalk.

56. Turbulent Transfer Mechanism and Suspended Sediment in Closed Channels, by Hassan M. Ismail. The relation between momentum transfer and sediment transfer in smooth, closed rectangular channels was studied. Application of this relation makes possible evaluation of momentum transfer coefficients at the central region of the channel using direct suspended load measurements. The paper describes the effect of sand in suspension on the universal constant of turbulent exchange, distribution of momentum transfer coefficient and the coefficient of friction. (Available March 1.)

57. Design of Irrigation Systems, by W. H. Nalder. An account of the planning and design considerations entering into the development of irrigation features of multiple-purpose projects of the Bureau of Reclamation is presented. Reviewed are the major factors affecting irrigation development and their attendant engineering implications, the elements of an irrigation system, and the influence of economics on design. The principal features of three Reclamation multiple-purpose projects are described. (Available March 1.)

58. Highway Planning in Turkey, by H. E. Hilts. Engineering activity in Turkey as a result of United States assistance, under the "Point Four" program, is recorded. The problem involves highway improvements in a nation somewhat larger than the State of Texas comprising 12,500 miles of national highways, 13,500 miles of provincial roads, and about 62,500 miles of city streets, village streets, and rural roads. The paper outlines preliminary organizational and planning details. (Available March 1.)

59. Limit Design of Beams and Frames, by H. J. Greenberg and W. Prager. A method of limit design of statically indeterminate beams or frames under load is presented. The limit moments under which individual sections act as hinges are presumed known throughout the structure, and a safety factor against collapse is sought. Two extremum principles for this factor are established. (Available March 1.)

60. Surveying and Mapping Requirements for Modern City Planning, by Charles A. Blessing. An outline of the need for reasonable standardization of mapping and surveying procedures by the city-planning commissions in all cities, large and small, is presented. The paper suggests map types and scales which have been found useful in a number of cities and proposes a revision of ASCE Manual No. 10 to include a more definite statement of surveying and mapping requirements for modern city planning from the point of view of the city planner, who is the user of the survey. (Available March 1.)

D-7. Discussion of Paper, **The Geochemistry of Earthwork,** by Hyde Forbes. The original paper, published in March 1950, presented observational and test data relative to the geochemical processes and the mineralogical changes set up in working with earth, in excavations and in engineering structures. Discussers are: Warren D. Smith, D. P. Krynine, S. S. Gorman, Charles H. Lee, George S. Harman, and Hyde Forbes. (Available March 1.)

D-XXV. Discussion of Paper, **Numerical Computation of Buckling Loads by Finite Dif-**

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ferences, by Mario G. Salvadori. The original paper, published in December 1949, explained the buckling problems that may be obtained by purely numerical computations, using a procedure of successive approximation. Discussers are: I. K. Silverman, Bruno A. Boley, G. R. Ramaswamy, Chi-Teh Wang, George Hermann, and Mario G. Salvadori. (Available March 1.)

Second Notice

61. Structural Damping in Suspension Bridges, by the late Friedrich Bleich and L. W. Teller. In three parts, this paper comprises (1) a theoretical study of damping capacity of suspension bridges resulting from internal friction and from various sources of dry or Coulomb friction in the structure, (2) an account of an extensive laboratory study of frictional damping in structural members, and (3) a correlation of the theory with experimental data. (Available April 1.)

62. The New Towns Program in Great Britain, by T. C. Coote. Fourteen new towns are now under construction in Great Britain. Two are in Scotland, eleven in England, and one in Wales. These new towns are being erected by development corporations which employ their own technical staffs or outside consultants. Construction work is gathering momentum, and in each of the earlier established new towns it is planned to erect about 1,000 houses, together with some factories and shops. Extensive civil engineering works are being undertaken to open up the sites. (Available April 1.)

63. National Geodesy—Status and Planning, by Leo Otis Colbert. From its inception, the United States Coast and Geodetic Survey has been engaged in establishing the horizontal and vertical controls necessary as a base for land surveys and engineering projects. The paper describes the development of the geodetic network, the status of control surveys, and the scheduling of future geodetic work. The role of the engineer in preserving existing reference points is emphasized. (Available April 1.)

D-8. Discussion of Paper, **Floating Tunnel for Long Water Crossings,** by Charles E. Andrew. The original paper, published in March 1950, outlined a study of possible methods, if any, of constructing a permanent highway structure across Puget Sound between Seattle, Wash., on the east and the mainland on the west shore. Discussers are: Robert S. Mayo, Homer M. Hadley, and Charles E. Andrew. (Available April 1.)

D-11. Discussion of Paper, **Long-Term Storage Capacity of Reservoirs,** by H. E. Hurst. The original paper, published in April 1950, presented a solution of the problem of determining the reservoir storage required on a given stream to guarantee a given draft. Discussers are: Ven Te Chow, Henri Milleret, Louis M. Laushey, and H. E. Hurst. (Available April 1.)

D-16. Discussion of Paper, **Pavement Bearing Capacity Computed by Theory of Layered Systems,** by Guthlac Wilson and G. M. J. Williams. The original paper, published in May 1950, described a method for calculating the bearing capacity of rigid and flexible pavements, which was based on the theory of layered elastic systems. Discussers are: Robert Ruckli, Hugh Q. Golder, and Guthlac Wilson and G. M. J. Williams. (Available April 1.)

D-19. Discussion of Paper, **Flood-Control Operation of Tennessee Valley Authority Reservoirs,** by Edward J. Rutter. This original paper, published in May 1950, discussed the actual flood conditions and actual and alternative hypothetical operations of the tributary and main-river reservoirs during these floods. Discussers are: Ray K. Linsley, Jr., and Edward J. Rutter. (Available April 1.)

D-23. Discussion of Paper, **Influence of Heavy Loads on Pavement Design Trends,** by K. B. Woods. The original paper, published in June 1950, developed the design of highway pavements through extensive use of test roads, the use of theoretical or rational procedures, and through the combined experiences of many highway engineers over a considerable period of time. Discussers are: William S. Pollard, Jr. and K. B. Woods. (Available April 1.)

First Notice

64. Planning the National Capital: Objectives and Problems of Attainment, by Ulysses S. Grant III. The important contribution made by engineers to the planning and development of Washington, D.C., is detailed. Discussed briefly are the current major problems of the city and the measures taken for their solution. The need for legislation to enhance the effectiveness of the Planning Commission is explained, and a federal and interstate Metropolitan Works Agency to provide for the financing and design of construction work needed by the metropolitan area as a whole is advocated but not as the direct responsibility of any one of the political jurisdictions. (Available May 1.)

65. National Topographic Mapping, by W. E. Wrather. The present status of topographic mapping of the United States and the rapid rate of obsolescence of the older topographic maps are discussed, together with standards and specifications that are expected to decrease the rate of obsolescence of modern quadrangle maps. The paper explains the manner and extent of cooperation in effect between the Geological Survey and other federal and stage agencies for the purpose of expediting progress on the national topographic mapping program and the practicability of a 20-year schedule for completing standard topographic quadrangles of the United States. (Available May 1.)

66. Lateral Forces of Earthquake and Wind, by a Joint Committee of the San Francisco, Calif., Section, ASCE, and the Structural Engineers Association of Northern California. This paper develops a dynamic criterion for design lateral earthquake and wind forces and a provision for building codes based on this criterion. The earthquake shear transmitted from the ground to a structure is related to the weight and natural period of vibration of the structure. This shear is resolved into lateral forces at various levels. The lateral force code, drawn for California conditions, is generally applicable with some modification. (Available May 1.)

D-13. Discussion of Paper, **Reinforced Concrete Skewed Rigid-Frame and Arch Bridges,** by Maurice Barron. The original paper, published in April 1950, presented a method of analysis and design that indicates the effect of skew on a barrel arch or rigid-frame structure. Discussers are: D. A. Nettleton, Ernest H. Harder, Egidio O. Di Genova, Kuang-Han Chu, Harold E. Levenson, Walter L. Schwartz, Leo Sos, Leif Arup, and Maurice Barron. (Available May 1.)

D-18. Discussion of Paper, **Successive Approximations for Beams on an Elastic Foundation,** by E. P. Popov. The original paper, published in May 1950, gave a general method for solving problems of variable moment of inertia of a beam and variable foundation modulus. Discussers are: Ralph E. Fadum, J. V. du Plessis, W. E. Hanson, Jacob Karol, E. E. De Beer and D. Krsmanovitch, and E. P. Popov. (Available May 1.)

D-21. Discussion of Paper, **Maximum Load Capacity of Bailey Bridges,** by Robert B. Stegmaier, Jr. The original paper, published in June 1950, reviewed the use of load tests in determining the maximum capacity of military bridges. Discussers are: D. Allan Firmage, and Robert B. Stegmaier, Jr. (Available May 1.)

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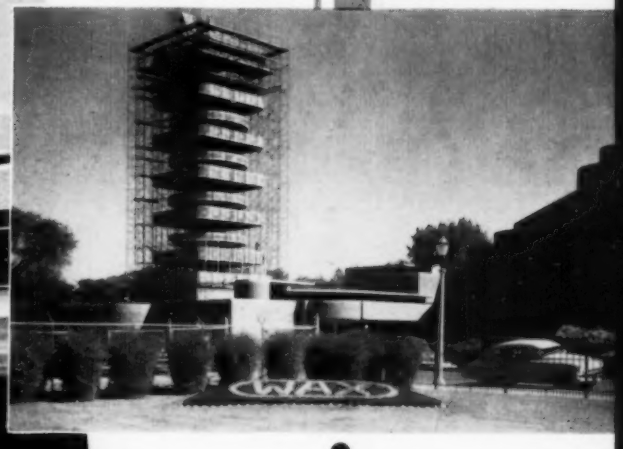

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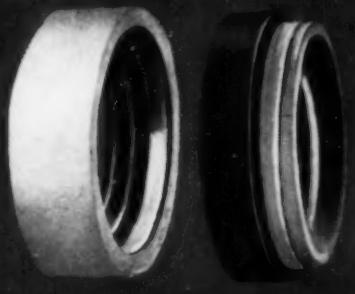

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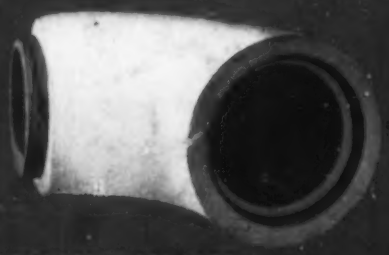

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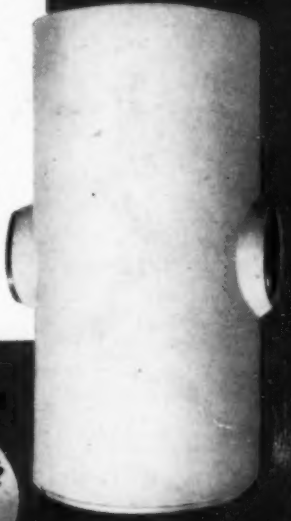

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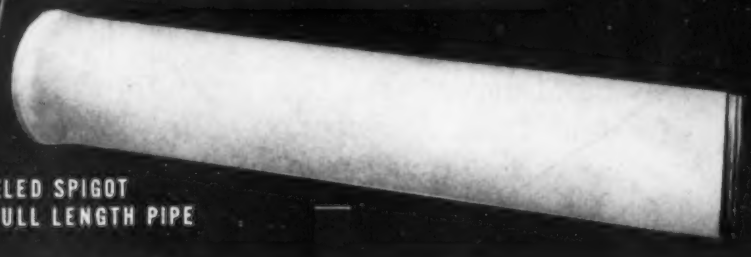

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